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AUTOMOTIVE and Aviation INDUSTRIES

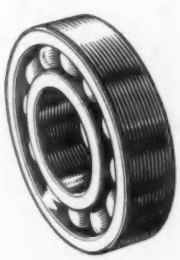
JANUARY 1, 1944

THE LIBRARY OF CONGRESS SERIAL RECORD
JAN 11 944

By-product of Victory

Enormous production for war, added to an already huge experience before Pearl Harbor, promises postwar performance of New Department Ball Bearings such as even we never dreamed of. *Nothing rolls like a ball.*

3221



New Departure
BALL BEARINGS

NEW DEPARTURE - DIVISION OF GENERAL MOTORS - BRISTOL, CONNECTICUT

JAN 10 1944

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.A6

Cutting oil *News* letter

Practical suggestions from the field on how cutting oils and coolants are being used by midwest machine operators to lick tough wartime jobs. **JANUARY, 1944**

How longer tool life was obtained in making 250 lb. "practice" bombs

Operations by a stamping company on 250 lb. "practice type" bombs included drilling, reaming, tapping of the nose, cutting off tail end, and chasing an internal thread. Several oils failed to do the job right. Then the operator switched to Stanicool H. D. Soluble Oil (6 to 1 mixture); said it not only produced a better finish, but gave much longer tool life.

Bothered by Buildup on Dies? This was a real problem to a northwest manufacturer . . . on the male die on a deep draw job (6 in. deep) using 26 gauge steel sheets. Two parts Stanostamp "C" to one part water applied by swab ended this problem; also gave longer tool life at reduced cost.

Released 8 Men for Other Plant Work.

In producing 90 mm. anti-aircraft shells, a wrench manufacturer bumped into two headaches: (1) Use of high grade cutting oil at high surface speed and depth of cut caused excessive smoke, made parts too hot to handle. (2) Discoloration of the copper bands kept eight men busy buffing them. Working with plant operators, a Standard Lubrication Engineer selected a special soluble oil for this job. Last report was: perfect work coming through . . . no more rejects . . . the 8 men released for other work in the plant . . . ordnance inspectors enthusiastic.

Didn't ask for extra tool life but got it . . . as a bonus! The main idea in this plant was to lick the twin problems of 10% rejects and breaking along the edges when stamping radiator fins. Variation in hardness of material was the root of the trouble . . . which completely disappeared after changing over to Acme Base Oil Extra Heavy mixed 1 to 6 with paraffine oil. And to top it all off, a 40% increase in tool life has been secured.

How to Prevent Staining on Aluminum After Machining. Here's a practical suggestion that will interest many operators handling aluminum parts. In order to get away from staining and deposits on aluminum after machining, a battery and parts maker tried out a number of cutting oils. Final report is that Stanicut 62 FC was the only one to give full satisfaction. It is now standard for this operation.

OIL IS AMMUNITION . . . USE IT WISELY

World's Largest Planer Takes 6 Cuts At Once. A rolling mill and foundry company recently installed what was said to be the largest planer in the world. It has a table weighing 75 tons, carries a load of 300,000 lbs., takes six cuts at one time. Six barrels of Stanolex No. 31 were placed in the system for dependable lubrication.

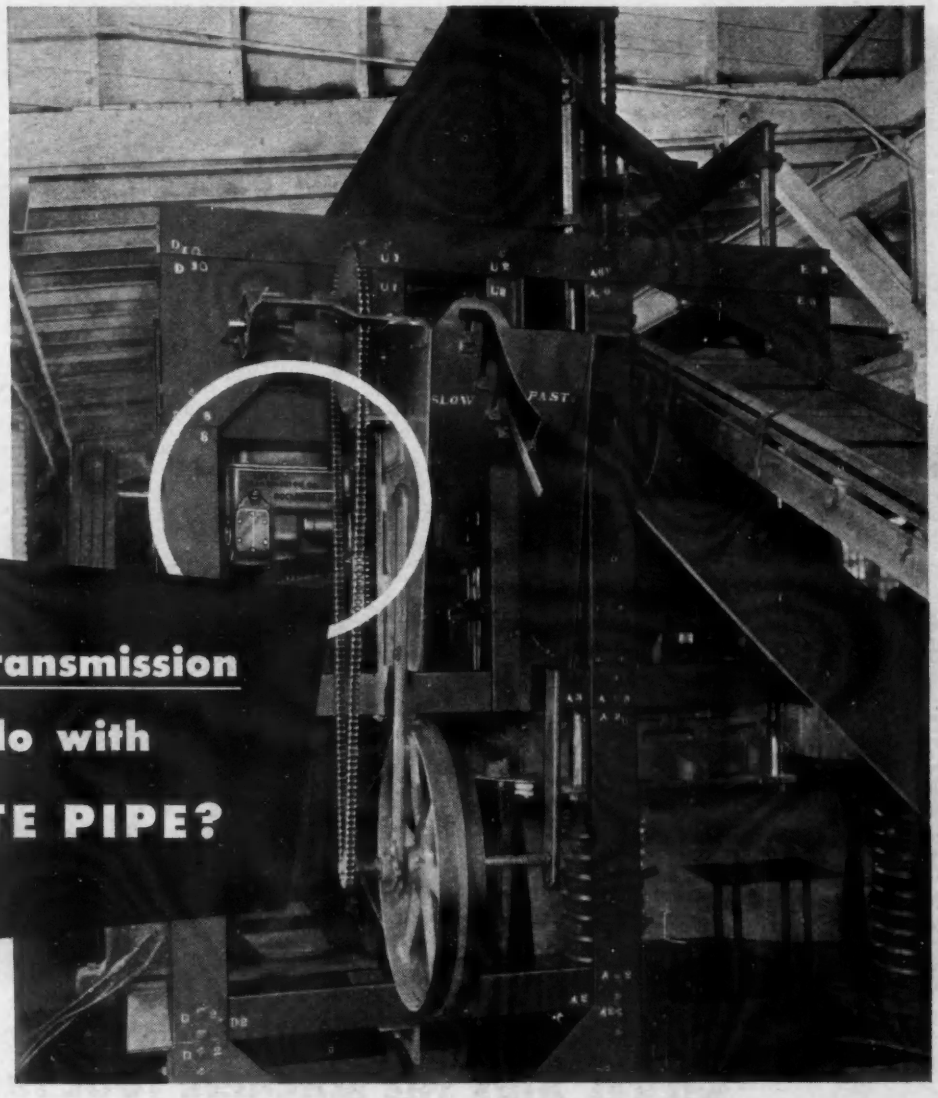
Army Inspectors Give Entire Approval. A farm machinery manufacturer, in recently converting to war production, found it difficult to secure approval of finish and cleanliness of parts for plating after machining and tapping SAE 4150 steel. They started using Premier Cutting Oil No. 110 about 5 months ago, and army inspectors have given entire approval on workmanship ever since. More ease in cleaning parts for plating with this oil was a plus advantage.

When You Bump Up Against Special Cutting Oil Problems

• If you are running into trouble in handling war work, and find it tough to get the necessary accuracy, finish, and tool life on converted machines . . . or if you have other perplexing machining jobs that a more efficient application of cutting oils may help answer . . . call in a Standard cutting oil specialist. Phone or write Standard Oil Company (Indiana) office, or 910 S. Michigan Ave., Chicago, Ill., for the Engineer nearest you. In Nebraska, contact any Standard Oil Company of Nebraska office.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

RICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION E



What's a Transmission got to do with CONCRETE PIPE?

ANOTHER COTTA "ENGINEERED-TO-ORDER" TRANSMISSION FOR CONCRETE PIPE MACHINERY CO.

The machine shown above makes plain and reinforced concrete pipe by the packer-head process. Concrete pipe is big and husky . . . you can imagine how rugged this machine's gear-box has to be! And for smooth, rugged, low-cost transmission of power, the Concrete Pipe Machinery Co. comes to COTTA. The 4-speed COTTA Transmission permits regulation of the speed of elevator for different size pipe. This heavy-duty application is typical of COTTA'S ability to apply custom-designed transmission units to many fields. For over 30 years COTTA has been a source of specially engineered transmissions for locomotive cranes, oil-well drilling rigs, power excavators, and the like. If you have a problem, a letter to us will receive prompt attention. Write for brochure today!

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An Assurance of Dependable Service

COTTA
HEAVY-DUTY
TRANSMISSIONS
PRECISION-BUILT • SPECIALLY ENGINEERED FOR YOUR PRODUCT

NICKEL AIDS THE MACHINE TOOL INDUSTRY

to KEEP 'EM WORKING!

Everyone marvels at the speed of American production for war . . .

But how many realize that much of the credit should go to machine tool designers?

They are the ones who created the *tools* for doing the job.

They're making production miracles commonplace . . . with the most efficient machine tools that ever whipped raw material into finished product.

And the secret? For one thing, they try to design each component part of a machine so that it outlasts the machine itself.

They know that failure of a single machine in a mass production setup might bring whole assembly lines to a stop.

So they lean heavily on Nickel alloyed materials for the critical parts of machine tools.

Over the years they have learned that Nickel contributes toughness, strength, and fatigue resistance . . . properties vitally essential to many different kinds of tool parts . . . from grinder frames to tail shafts, from gears and spindles to drill chucks and lathe beds.

In the industries which use machine tools, it's an axiom that "a little Nickel goes a long way" to keep 'em working.

Whatever *your* industry may be . . . if you want help in the selection, fabrication, and heat treatment of alloys . . . we offer you counsel and data.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects — from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

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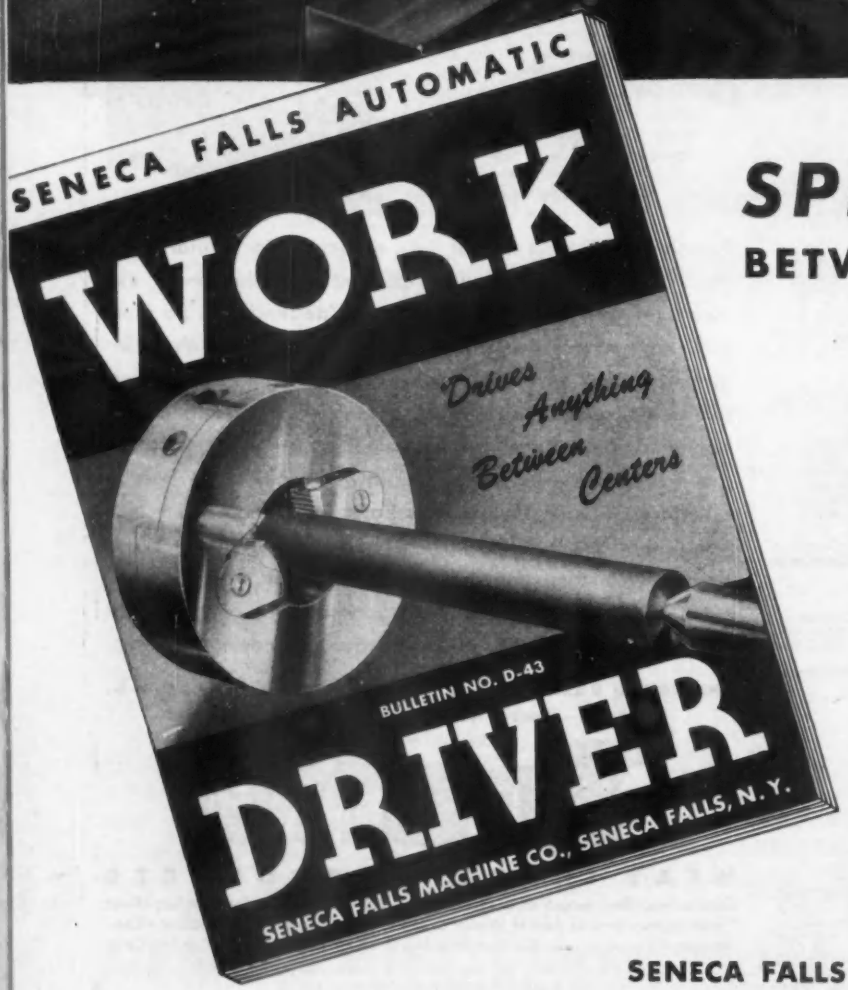

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The Seneca Falls Automatic Work Driver is a self-centering, quick-acting Driver designed to eliminate dogging time, thus permitting one operator to operate two or more machines. Its positive grip prevents slippage and resulting tool breakage. It provides greater safety for the operator since there are no projecting screws or sharp corners to catch clothing or injure hands. It can be used on any type of engine lathe, multiple tool lathe and on plain or universal grinders. Can also be used for certain work on turret lathes.

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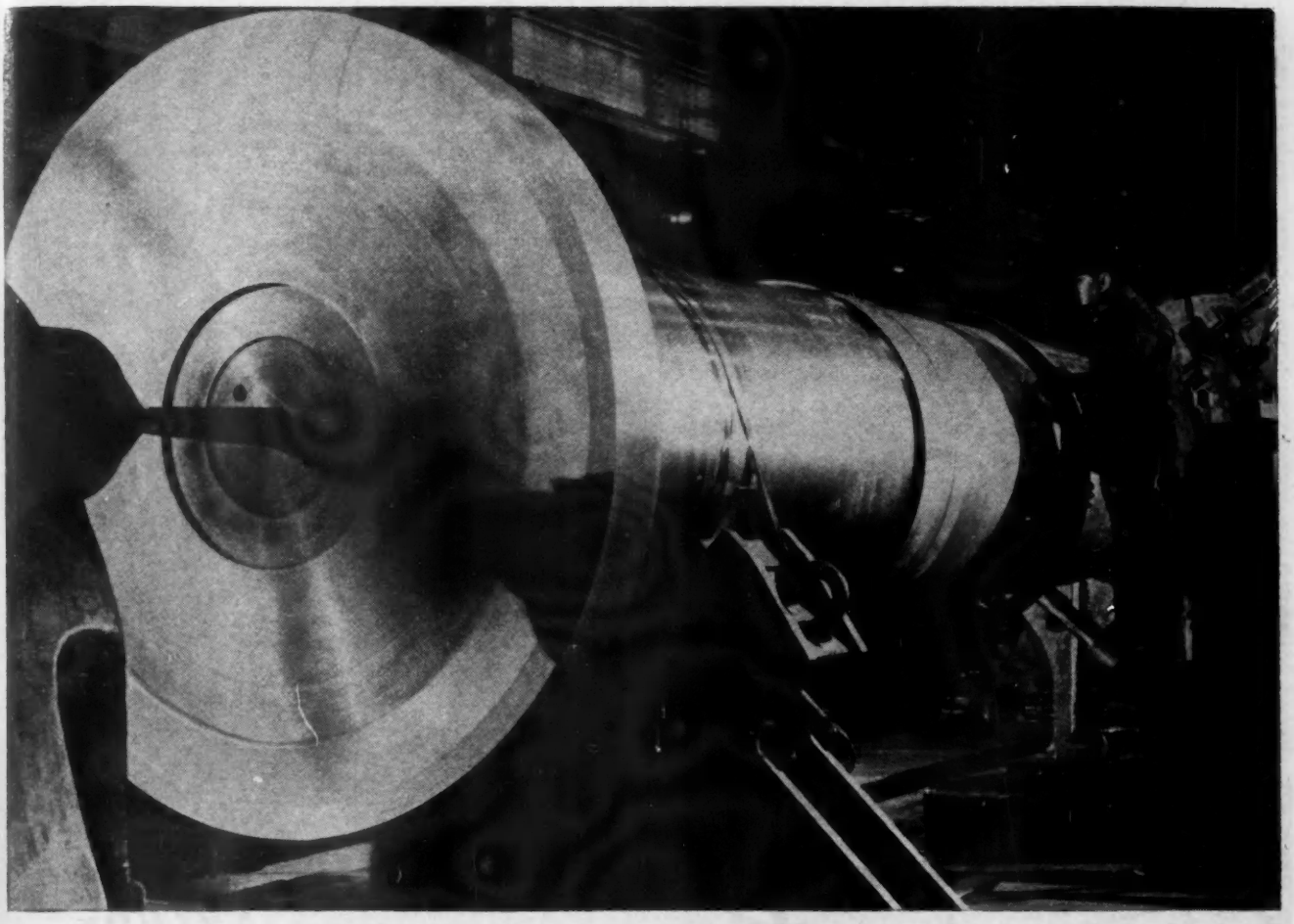
LATHE NEWS from SENECA FALLS



Close Shave

WHETHER machining a forging for a 75-ton shaft or turning out delicate parts for aviation instruments, American mass production methods are employed.

Regardless of the material to be machined, properly selected cutting fluids play a vital part, substantially reducing both time and cost.

For example, *Texaco Cutting* and *Soluble Oils* permit higher speeds and feeds, lubricate the tools. By carrying away the heat they prevent chip welding, improve surface finish and increase tool life.

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Controller is mounted on the under side of steering wheel.

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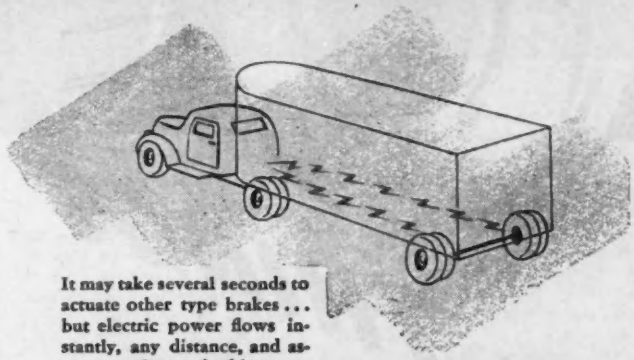
Instant Brake Action... *No Time-Lag*

With ideal road conditions, if your truck is traveling at a speed of 20 miles per hour, the distance required to stop is 30 feet. This distance is increased 29 feet each second of time-lag between the time the brake is applied and the time the vehicle stops. The further the rear wheels are from the driver's seat, the greater the time-lag, and the more distance needed for stopping.

With other type brakes there is serious time-lag but with WARNER ELECTRIC BRAKES there is *no* time-lag. The electric braking power, applied in any desired amount at the controller on steering wheel, travels instantly to the wheel brakes and regardless of whether the rear wheels are 10 feet or 100 feet back from driver's seat, instant braking is certain...you can *depend* on a smooth 30-foot stop from a speed of 20 miles per hour.

At the present time the needs of our armed forces must be served first. However, if you are in the "essential" category, we can arrange to furnish Warner Electric Brakes.



It may take several seconds to actuate other type brakes... but electric power flows instantly, any distance, and assures instant braking.

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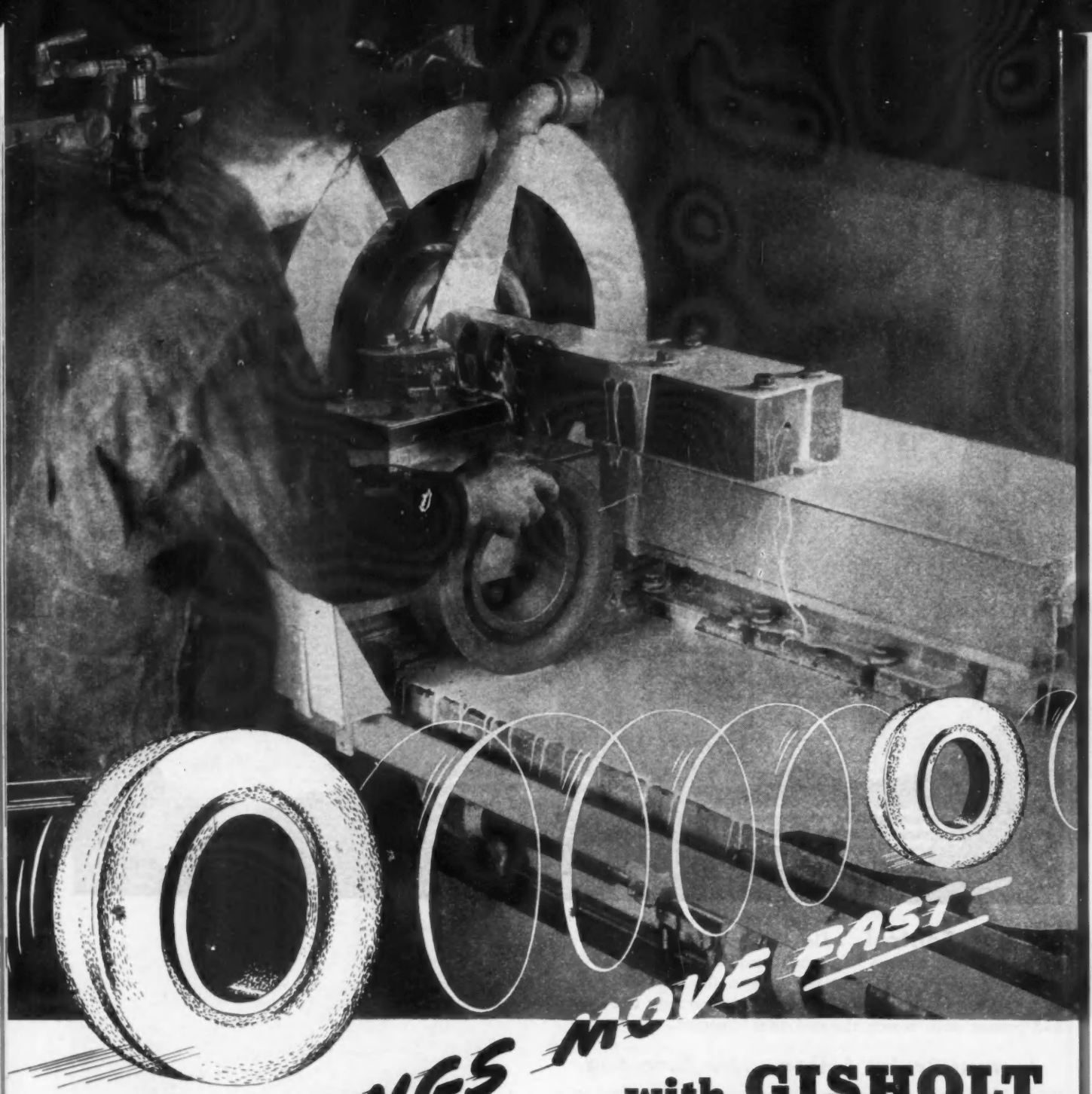
WARNER ELECTRIC BRAKES

WARNER ELECTRIC BRAKE MANUFACTURING COMPANY, BELOIT, WISCONSIN



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For the immense volume demanded for war production, Gisholt Simplimatics have provided the answer in many vital plants. Fully automatic operation makes short work of jobs that would otherwise take long hours and intense concentration. Operator fatigue is practically eliminated. Yet, with all its high speed production, you can depend upon the unfailing accuracy that has made "Gisholt" a byword for precision wherever machining work is done.

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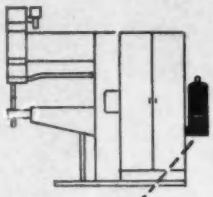

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a d-c current interruptor — *without arc*

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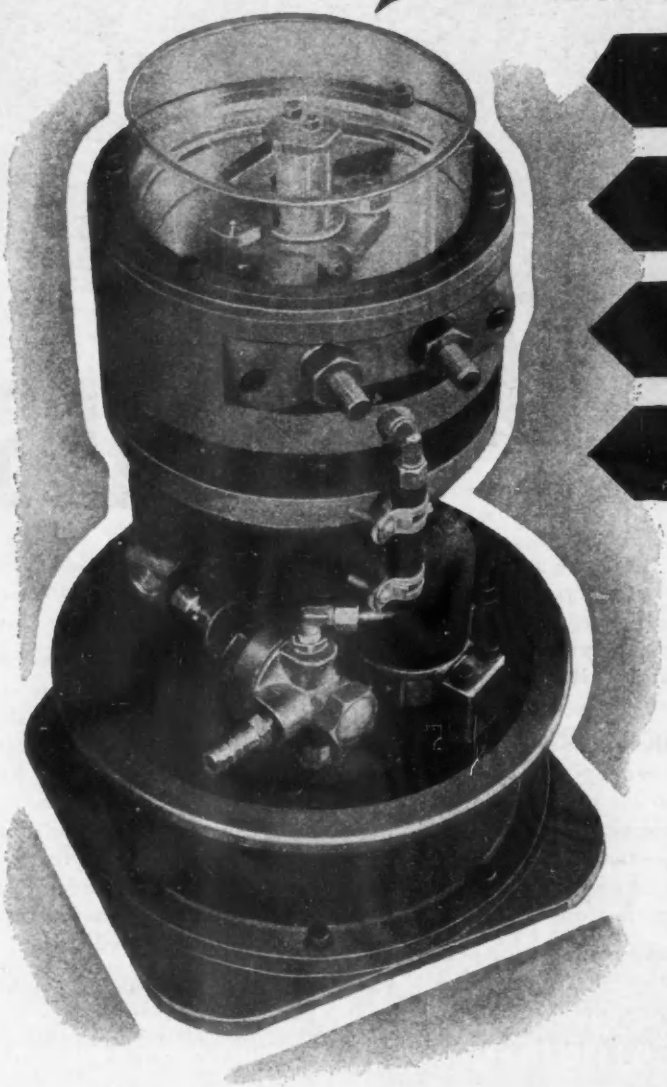

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- INCREASED EFFICIENCY OF ELECTRO-MAGNETIC ENERGY SYSTEM — SHORTER CHARGING TIME
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However, in industrial production, the continuous arcing finally results in a deterioration of the contact tips, requiring periodical maintenance and replacement. It was considered desirable to solve this problem in such a way that the same consistent welds be produced without any maintenance of the interrupting device. To this end, the DYNATROL was developed and was found to be not only a means of more accurate and efficient current interruption, but also, because of the shorter charging time, *actually increases operating speeds 20%.*

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the shadow of GEARS

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And back of these planes—back of the giant 2,000 horsepower engines that power them are gears. Gears of such extreme precision—held to such close tolerances—that each one is a modern marvel of engineering and manufacturing perfection.

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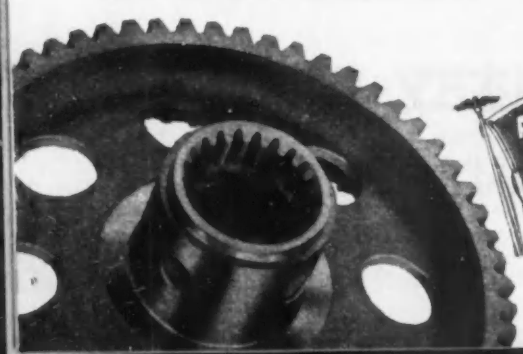
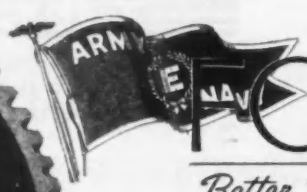
FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 S. Western Blvd. • Chicago 9, Illinois





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Better Power Transmission Through Better Gears

The Standard for Tomorrow!

The Emphasis Will Be On More Accuracy . . . With Production

The trend for tomorrow's civilian production is definite . . . the increasing use of special or semi-special machines that will enable manufacturers in general to attain the extreme accuracy the users of high precision machines are now obtaining in the aircraft and other war industries. Typical of these precision machines is the one illustrated here, a practical application of the Ex-Cell-O precision boring process to vital aircraft parts. This Ex-Cell-O machine indicates the flexibility, accuracy and simplicity in use, with resulting money-saving, that will be demanded of *precision* machine tools tomorrow.

This Ex-Cell-O machine was designed to produce extremely accurate holes in aircraft tail turret rings and cradles at exactly 90° around the outside of the part, and do this on a satisfactory production basis. The machine is of the three-way type, utilizing standard precision boring end sections with a special cast center section to which the three units are attached. This arrangement insures accuracy and at same time allows for utilization of end sections on post-war work. Two parts are machined; one a tail turret ring of steel *(in insert)*; the other, a tail turret cradle of magnesium *(on machine)*.

EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

XLO

EX-CELL-O *for* PRECISION

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● A modern permanent-mold foundry is an important unit of Dow's complete fabrication facilities for supplying you with Dowmetal Magnesium Alloys in all fabricated forms.

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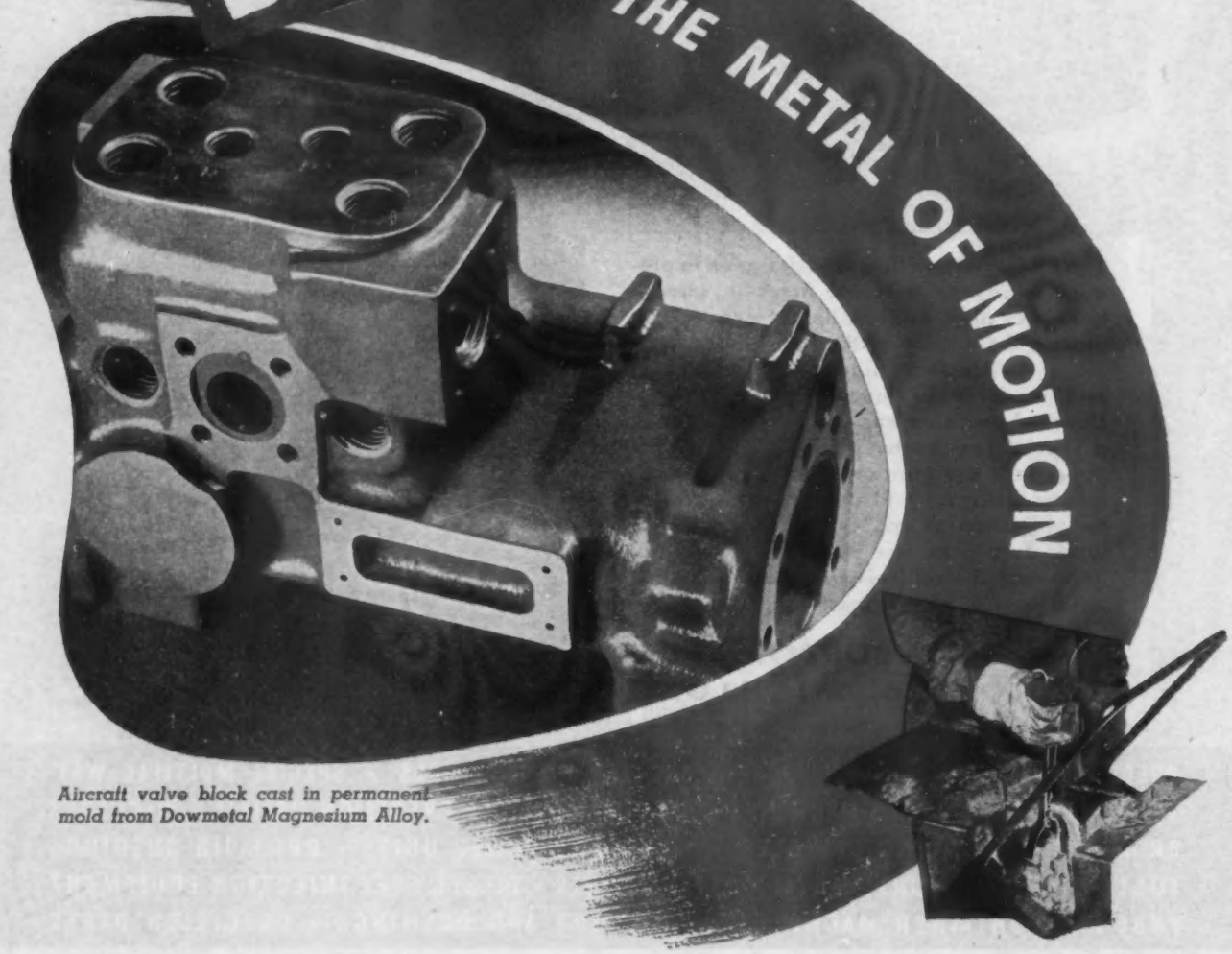
DOWMETAL *magnesium products*

THE METAL OF MOTION



Aircraft valve block cast in permanent mold from Dowmetal Magnesium Alloy.

Wasn't it always done this way?

P&H Zip-Lift HOISTS

No, Miss Victory, it wasn't!

You're one of thousands of women workers who'll never know the drudgery of old-fashioned materials handling methods—the fatiguing work this job formerly involved. Your Zip-Lift Hoist was installed to provide the simplest, safest way of lifting heavy parts on and off machine tools. Without it, this would be a back-breaking job—that's sure!

As more and more inexperienced men and women take their places in industry, management is providing a practical way to reduce basic training, to lessen fatigue, and speed production through simpler handling with the P&H Zip-Lift—the only small hoist with full magnetic push-button control. Write for literature.

Available in 250, 500, 1000 and 2000 lbs. capacities. Plugs in on any standard lighting circuit.

ARMY E NAVY

A new star has been added to P&H's award for excellence in war production.

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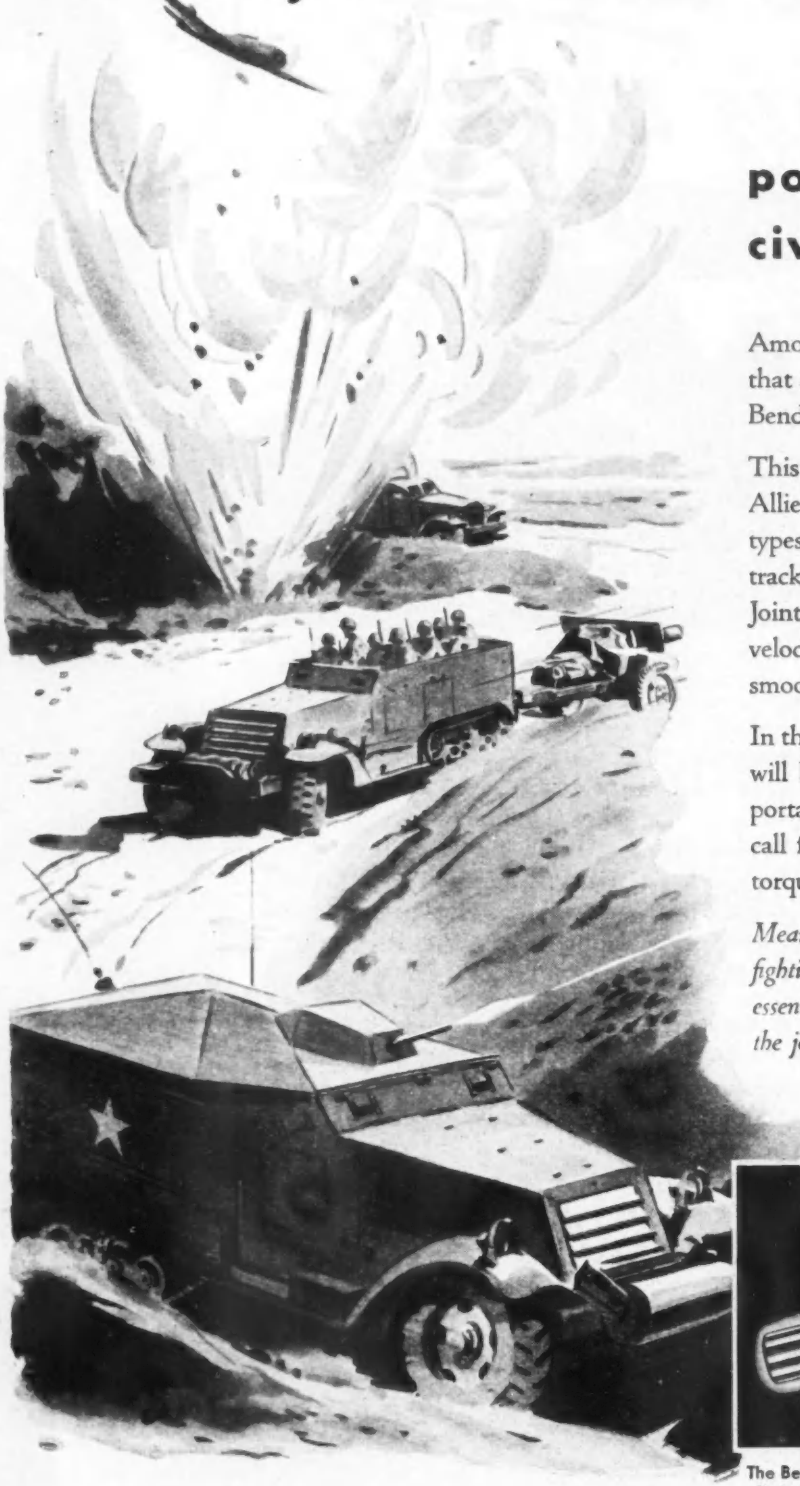

. . . and smoother power transmission in civilian vehicles

Among the peacetime products made by Bendix that are now a part of its wartime assignment is the Bendix-Weiss* constant-velocity Universal Joint.

This device is today taking its part in the great Allied offensives on world battle fronts. On many types of military vehicles, including trucks, half-tracks and amphibians, the Bendix-Weiss Universal Joint, by eliminating fluctuations in driving shaft velocities, is setting new standards of efficiency for smooth power transmission.

In the new day that is coming, this Bendix* product will be back from the war to serve civilian transportation needs in numerous new applications which call for smooth, vibrationless transmission of high torque at large angles.

Meantime, Bendix is not forgetting that part of its fighting assignment is to help service men keep war-essential civilian trucks, buses and passenger cars on the job.

* *Trademark of Bendix Aviation Corporation*

The Bendix-Weiss* Universal Joint utilizing the rolling-ball principle eliminates variations in angular velocity and insures smooth action at high operating angles. Because of the lengthwise rolling of the balls in the races, the need of a sliding spline is avoided.

THE INVISIBLE CREW
Precision Equipment by
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of Bendix Aviation Corporation
South Bend, Indiana

STROMBERG* CARBURETORS • BENDIX B-K* VACUUM POWER BRAKES
BENDIX* BRAKES • BENDIX-WEISS* UNIVERSAL JOINTS • BENDIX* CLEANERS

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AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Tinkering Will Not Do

By Julian Chase

WAS there or will there ever be a better time than now to take the necessary preliminary steps toward the complete demolition of our present federal tax structure and the building of a new one—a sound and stable one built from the very bottom of the foundations up, according to scientifically drawn, long-range plans designed by competent economic experts? Who questions that there is urgent need for such wholesale reconstruction? We must have it if the American System of Free Enterprise is to function as it can to the greatest benefit of the country and all its citizens in postwar years. In all likelihood there never was a more auspicious time for the successful carrying out of such an important national undertaking. There are few similar national jobs that could be accomplished with greater resulting profit.

To say that our present federal tax structure is a depressing, discouraging, and potentially tragic load on the backs of our over-patient taxpayers, individuals and corporations alike, and a brake on our entire national economy, is to put into words a fact of which the threatening consequences, surprisingly, are not sufficiently appreciated by our law makers, excepting, as we must, certain ones among them.

Our Government could wisely adopt the well-proved business policy of lower prices, smaller unit profits, greater production, more customers, and higher overall net. There is evidence aplenty that excessively heavy corporation taxes and oppressive personal income taxes seriously curtail profit-seeking, job-making enterprise and stifle individual initiative, the two prime movers which give impetus to the American industrial machine. It is the height of folly to reduce the beneficial effects of either through discouraging taxation.

An economically sound tax policy, built into a stable system of taxation, set up on a long-range basis, will inspire initiative, encourage enterprise, create jobs, increase production, raise our national income and swell our tax collections. To get it, we must tear down the old, excavate deep down to economic bedrock and then, upon a firm and scientifically planned foundation, build a structure wholly new and radically different from the patched-up, incentive-destroying makeshift which we have today.

Taxes and jobs are linked inseparably together. The saner and more stable the taxes, the greater the number of jobs. That's fundamental.

When the Starter Fires His Gun...

● A complete analysis of machining requirements for your post-war products will serve as a spring-board towards rapid conversion to building the type of product which you have in mind. It will eliminate much of the idle time long associated with changes in designs . . . provide jobs more quickly.

This is where CINCINNATI Service Engineers can help you. They have years of experience in working out methods of producing parts requiring machining operations in the fields of milling, grinding, broaching, lapping and cutter sharpening. The most modern data, substantiated by a staff of research engineers, is available for their estimates. They have a wide choice of machine tools for their recommendations, from a 4" Plain Grinder to a 36" Horizontal HydroTel Milling Machine with 120" table travel. One of their typical analysis sheets is shown here . . . note that 24 of the operations are done on machines bearing the CINCINNATI trade mark.

Our Service Engineers will be glad to recommend machines, fixtures and cutters for manufacturing your post-war product. Why not talk it over with a representative from our company?

CINCINNATI

PART NAME
REQUIRED PRODUCTION - PER HOUR
OPER. NAME
PRODUCTION NOT COUNTING SET-UP
SKETCH
OUR ORDER NUMBER
MACHINE
1. DRILL TWO 15/16 HOLES
2. BURN OUT
3. HEAT TREAT & BRINNELL
4. RGH SLOT TO .845 TO 7.487 .851 TO 7.495
5. STRADDLE MILL SIDES & BOTTOM
6. BROACH 1 SIDE BETWEEN EARS TOP OF TRUNION & 1 SIDE OF EARS
7. BROACH TOPS OF EARS
8. BROACH OPPOSITE SIDE-SAME CUT
9. STRADDLE BROACH EARS-1ST. CUT
10. STRADDLE BROACH EARS-2ND. CUT
11. FORM BROACH ENDS 1ST CUT
12. FORM BROACH ENDS 2ND CUT
13. STRADDLE BROACH EARS 3RD CUT
14. BROACH BETWEEN TRUNIONS & EARS
15. BROACH 1ST. CUT BETWEEN EARS & TOP STEP 3 DEG. & 6 DEG. ANGLE 1 END.
16. BROACH 2ND CUT BETWEEN EARS, LOWER STEP 3 DEG. & 6 DEG. ONE END, AND 6 DEG. ANGLE OPPOSITE END.
17. DRILL FOUR .393 HOLES, ONE 7/16" HOLE AND HOLLOW MILL TRUNIONS
18. PROFILE CONTOUR OF EARS
19. MILL BEARING PADS
20. MILL 75 DEG. & 7 DEG. ANG. CUT
21. MILL .394 X .079 SLOT IN EARS
22. MILL .678 X .433 DIM.
23. MILL .394 X .089 SLOT IN EA. SIDE
24. MILL 30 DEG. CUTS X .236 DIM.
25. PROFILE .472 ELONGATED HOLE IN RIGHT END
26. FINISH PROFILE 1.004 TO WITHIN .197 OF BOTTOM
27. PROFILE 1.496 AND .984 DIM.
28. PROFILE .118 CUTS
29. PROFILE 1.004 AT BOTTOM
30. DRILL .502 RAD. IN RIGHT END
31. REAM .492 RAD AND 1 DEG. 26' ANGLE
32. FORM CUT RADIUS NEAR TRUNION
33. POLISH EDGES ALL OVER
34. FILE WHERE NECESSARY
35. PARKERIZE
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Left: General Catalog, No. M-995-1. Contains illustrations and condensed information on complete line of CINCINNATI Milling, Grinding, Broaching, Lapping and Cutter Sharpening Machines

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING MACHINES

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

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Financial Plight of America's Aircraft Industry

By
Lucien W. Shaw
Assistant to the President, Lockheed Aircraft Corp.

THE enormous expansion of the aircraft industry has placed it in a position which will result in an extreme hazard at the conclusion of the war. The financial problems that must then be met will be so serious that there are no adequate measures which individual companies can take to protect themselves from possible disaster. This situation can be explained best by showing in summary form certain data recently presented by the Harvard School of Business Administration in a booklet entitled "Financial Position of the Aircraft Industry."

In preparing the study Harvard obtained from 11 major aircraft manufacturers their audited financial figures for 1942 (the latest which are available) and earlier years. These 11 companies produce over three-fourths of total warplane output in the United States. By dividing the totals of the financial figures by the number of companies represented, Harvard obtained figures for an "average aircraft company" as typical of the industry. For purposes of comparison, general industry is represented by 23 industrial corporations that are considered by a Government agency to be representative of the whole industrial organization of the United States. The accompanying seven charts, which have been prepared from the Harvard data, illustrate very aptly the basic facts of the financial condition of the aircraft industry.

Aircraft companies are seriously concerned as to the huge amounts of inventory for which they are responsible (see chart 4). The risk of loss upon termination of contracts with respect to inventories is very great. The reasons for this are well set forth in the Harvard study.

"The average company had expanded its production twenty-fold in a period of three years, and under conditions which made it necessary to subordinate all other considerations. The control of inventories has been hampered by such factors as frequent design changes, schedule

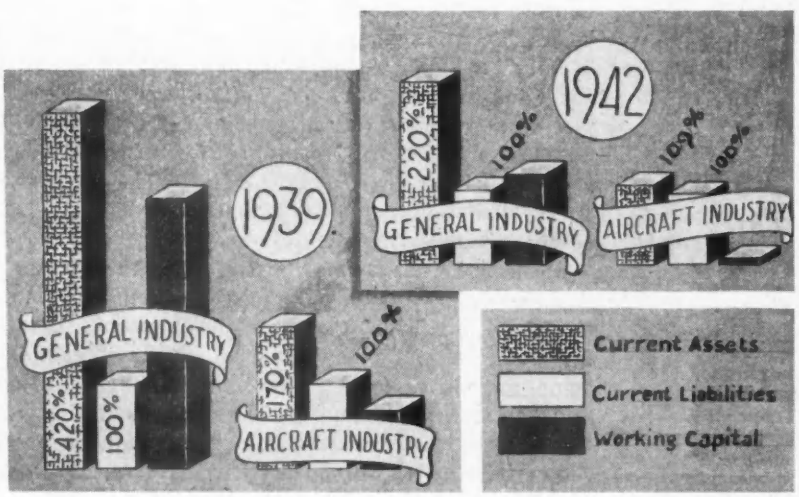


Chart One

Ratio of current assets to current liabilities, the former consisting of cash, marketable securities, receivables and inventories, and the current liabilities comprising all obligations due within one year. The 11 aircraft manufacturing companies in 1942 had a ratio of current assets to liabilities of $1.09 to $1.00, while for general industry (23 companies) the ratio was $2.20 to $1.00.

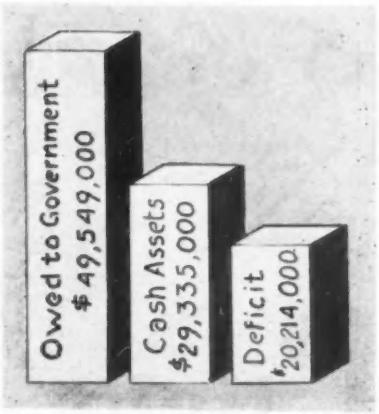


Chart Two

The "average aircraft company" owes far more to the Government than it has in "quick cash" assets.

THIS analysis of the financial status of the aircraft manufacturing industry in the United States was presented recently by Mr. Shaw to the Senate Finance Committee and the Senate Committee on Postwar Economic Policy and Planning when he appeared before them on behalf of more than 100 companies of the Aeronautical Chamber of Commerce of America. In September Ralph S. Damon, vice president and general manager of American Airlines, and Francis A. Callery, vice president in charge of finance at Consolidated Vultee Aircraft Corp., presented similar information as spokesmen for the East Coast and West Coast aircraft manufacturers at renegotiation hearings of the House Ways and Means Committee. Mr. Callery, who also represented the aircraft industry at hearings of the House Naval Affairs Investigating Committee, discussed various phases of the aircraft industry's problem of postwar reserves in the Sept. 15, 1943, issue of *Automotive and Aviation Industries*.

changes, sudden shifts in the demand for spare parts, a high labor turnover, inexperienced clerical and supervisory personnel, and frequent rearrangements of factories and warehouses.

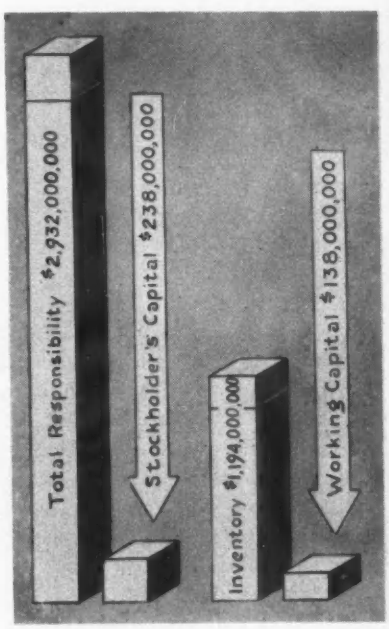
"All these factors have had an effect on the ability of the average company to maintain inventory records comparable with those which would be kept under normal peacetime conditions. For example, few if any of the major warplane manufacturers take a physical inventory at their fiscal year end, for such inventory-taking would involve a slow-down of production. Any simultaneous physical checks on all work-in-process are impractical in view of the vast numbers of parts and the interference with production which would be involved. Although the companies do usually employ a crew of men who make a continuous count of raw material items throughout the year, the difficulties of maintaining controls comparable with normal peacetime standards are great.

"Appreciable amounts of obsolete or surplus materials tend to accumulate in inventories under such conditions."

Our tax structure, and to some extent, renegotiation, has been based on the theory that prewar earnings and invested capital are the proper measures to determine reasonable profits. In many instances this is proper. However, it does not take account of the great risks resulting from over-extended operations. As the demand for planes has forced the aircraft companies to expand their volume way beyond what sound business management would have dictated, the only protection which they can have against these forced risks is sufficient reserves which can be set

Chart Four

This chart shows that an 8 per cent decline in the value of the aircraft industry's assets (11 companies) will wipe out stockholders and an 11.6 per cent decline in value of inventory will wipe out working capital. Inventory includes Government-owned for which companies act as custodians.



aside to provide for these contingencies when they arise. The figures show that the tax structure and renegotiation have not made a sufficient allowance for this purpose. The Harvard study shows that, after taxes and renegotiation, the aircraft industry was allowed profits of only 2.7 per cent on sales in 1942. This may be compared to 8.3 per cent for General Motors, 13.8 per cent for duPont, 7.5 per cent for Sangamo Electric, 10.6 per cent for Deere & Co., 10.5 per cent for Eastman Kodak, and 7.4 per cent for Johns-Manville. In 1939, the aircraft industry earned 10.4 per cent. Chart 7 shows the aircraft industry has followed a very conservative policy with respect to its earnings.

While it is impossible for the aircraft industry to make precise estimates as to postwar requirements due to the uncertainty of aviation developments, demand for aviation equipment, size of military establishment, and other factors, nevertheless there are several factors which support the conclusion that substantial financial resources must be available at the end of the war if the industry is to survive.

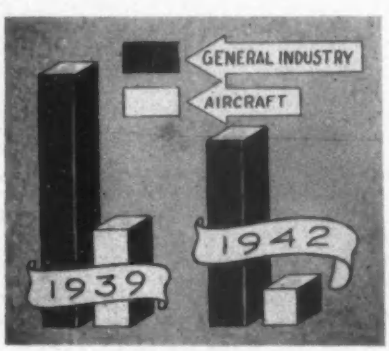


Chart Three

Working capital of general industry (23 companies) and the aircraft industry (11 companies) as per cent of inventory (company owned).

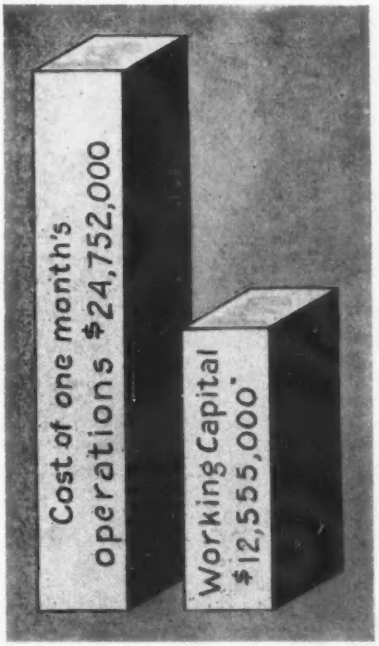


Chart Five

Working capital of the "average aircraft company" will pay wages, salaries, and material expenses at the 1942 level of operations for only two weeks.

First, it is very probable that the aircraft companies will suffer losses upon the termination of their contracts. In view of the enormous expansion and the constantly changing conditions under which the companies have been operating, it seems inevitable that they will not be able fully to support all of the expenditures and costs which have actually incurred. They are doing their best to maintain adequate accounting systems, but it seems probable that unavoidable wartime human error will cost them substantial sums on contract termination settlements. In addition, they will have substantial expenses for rearrangement of their plants and facilities to be ready to carry on peacetime production.

The industry does not believe that the American people wish the aircraft manufacturers to be supported solely at Government expense by maintaining the industry entirely upon postwar production for the Army and Navy. Aircraft companies foresee a great future for postwar commercial and private aviation. To be ready to meet this future, however, a great deal of work must be done in product engineering which the companies are of course not able to do during the war. The development of models for postwar aviation will be extremely costly. Great efficiency in airplane equipment is being achieved, but the models are very complicated. It will undoubtedly require $3 or $4 million for engineering work alone to develop a design for an advanced, large-size commercial transport after the war. Furthermore, the engineering work must be followed by a costly period of tooling up. It is very likely that $15 million or more will be expended by a single company on one model before the first unit is completed and ready for delivery. Not until then will income from it start to flow in.

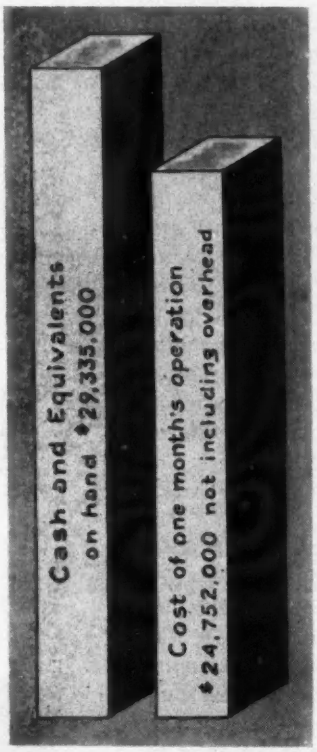


Chart Six

Liquid funds of the "average aircraft company" are sufficient to pay expenses at the 1942 level for only 5 weeks.

When we turn our thoughts to development of private planes the prospect is similar. Private planes will take their place in American life only when mass production of them is achieved. The engineering work and tooling required to accomplish this will again be very costly and run into many millions of dollars.

(*Turn to page* 146, *please*)

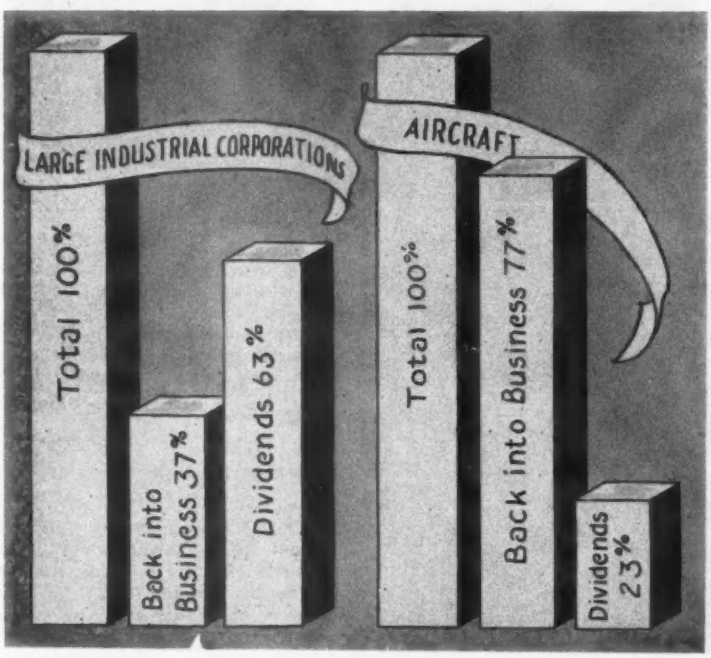


Chart Seven

The average utilization of profits for 10 large industrial corporations outside the aircraft field and for 11 aircraft companies is shown in this chart.

This Article Provides an Excellent Over-All Picture of the Complex Operations Involved in the Manufacture of Sleeve Bearings and Bushings to Many Designs

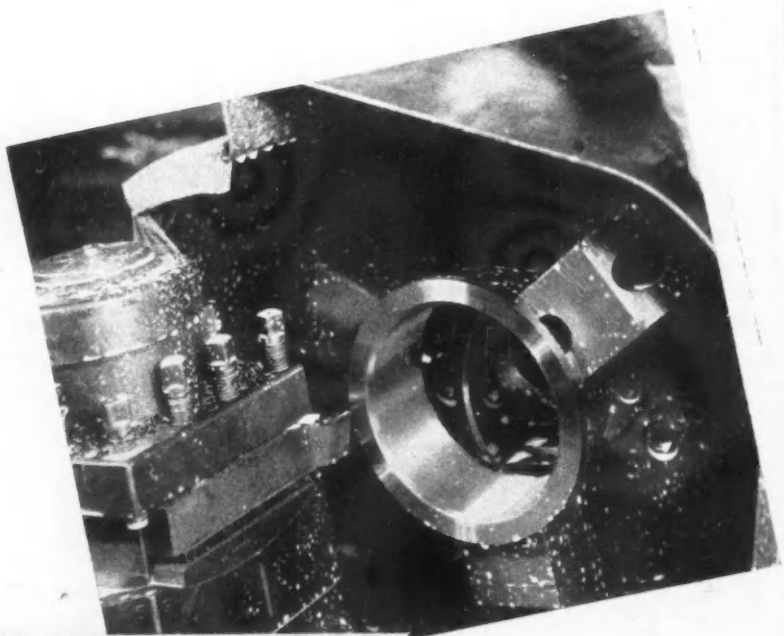
This is the Eighty-ninth in the series of monthly production features

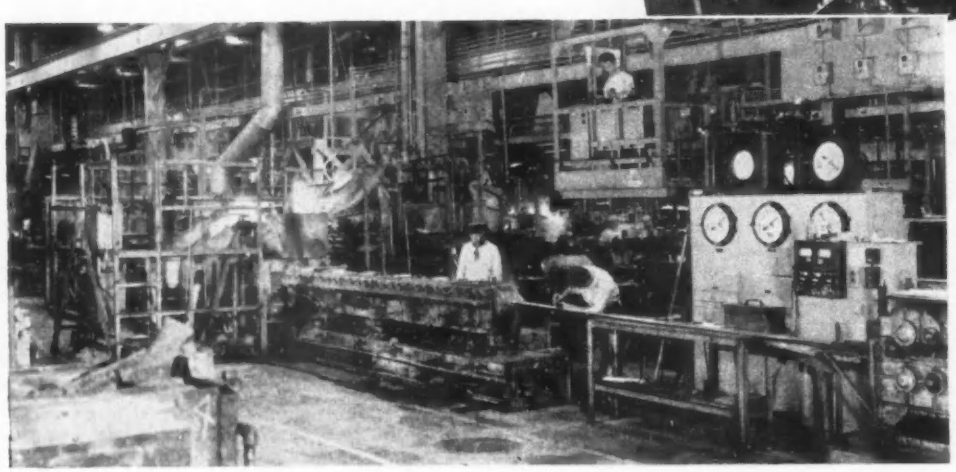
High Degree

WHAT with the emphasis on bearings and bushings for automotive and aircraft engines due to the almost fantastic demands of the war program, a better grasp of the problem may be obtained by a first hand study of what it takes to make them. For one thing it should be appreciated that modern automotive type precision or sleeve bearings are required to carry unit loads completely out of the range of handbook standards. The design and manufacture of such bearings brings to bear a rare combination of art and science in the field of lubrication, chemistry, electrochemistry, and metallurgy in addition to specialization in machine shop practice.

An excellent opportunity to mirror the manufacture of such bearings is offered by The Cleveland Graphite Bronze Co., whose new plant represents the latest developments in the art, in one of the largest of such operations in the automotive industry. The activity of this company is actually divided between two main plants—the original home of the organization, now devoted to the manufacture of large Diesel engine bearings, bushings, and a Ford department; and the new plant specializing in automotive type precision bearings and a complete line of aircraft bearings and bushings. The latter plant is composed of three separate buildings—the central structure housing offices and machine shops, the strip plant, and the casting department.

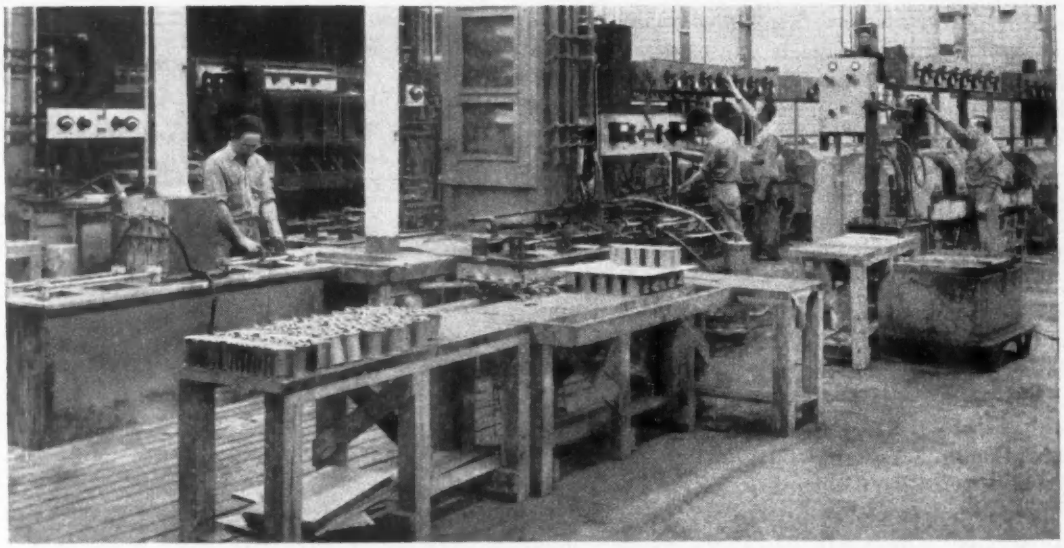
Needless to say, the pressure of bearing production demands flexibility to the greatest degree. For some idea of what flexibility really entails consider that the automotive department processes some





(Above) Work station of Gisholt turret lathe illustrating the chucking and tooling for turning, facing, and boring of an aircraft bearing shell.

(Left) Perspective view of one of the continuous strip mills with the pouring station at the left.



General view in a corner of the silver plating department, showing cleaning tanks and plating equipment.

# of Flexibility

at Cleveland Graphite Bronze Co., Plant

By Joseph Geschelin

1000 types of shells while the aircraft department produces more than 150 distinct types of bearings and bushings. Generally speaking, this company produces the following types of bearings:

AIRCRAFT—Sleeve type copper-lead alloy bearings, Sleeve type copper-lead alloy bushings, Sleeve type silver bearings and bushings, Thrust washers and special types with copper-lead or silver faces.

AUTOMOTIVE—Thin-wall precision type bearing shells produced from strip, coated with copper-lead or lead base alloys, Clevite bushings made from copper-lead coated strip.

In addition there are tri-metal bearings made from strip or of sleeve type, cast in two separate operations. Latest development is a line of strip type bearings for aircraft engines still in experimental production stages.

Although the machine shop operations occupy the major part of the floor space and are more spectacular to the casual observer, the fact is that the character of the bearings—performance, life, conformity to specifications, bond, etc.—depends almost entirely upon what happens in the strip mill and in the casting department.

Consider an automotive precision bearing. The strip mill operation, to be described later, is a continuous and automatic process in which the strip is handled in coils, proceeds through mills where it is chemically washed, tinned, coated with babbitt or copper-lead alloy, shaved to proper thickness in a

Bore of automotive strip type bearings is finished to a high polished finish and fine tolerances by a special broaching operation as shown.

milling cutter station, then coiled ready for the machine shop. The initial stage is one of scientific controls and techniques. In the machine shop the strip goes, first, through a series of press operations—cutting blanks, forming, and sizing. This is followed by the relatively simple stages of machining.

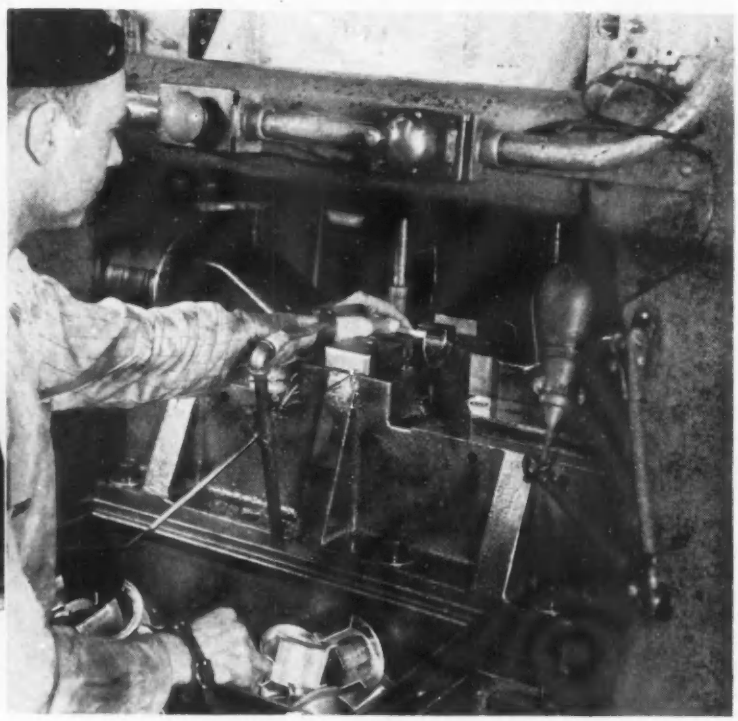
An aircraft bearing, made from tubing or a forging or turned from bar stock, poses greatly more complication. Aside from a multiplicity of machining operations in the final stages, the work in the casting department is exceedingly painstaking and involves techniques with which the layman is seldom familiar. For example, the copper-lead bearings are produced by a specialized foundry technique in which each bearing is treated as a foundry mold, fitted with cores, and subjected to various stages of heating, pouring, quenching, and rough machining. Silver-lined bearings are processed in the silver plating department where inner and outer linings are applied in separate operations by electro-plating. It is only after these preliminary operations have been completed that the aircraft bearing is ready for the machine shop.

Let us now examine the production process more in detail. The new plant is an excellent example of modern industrial construction, featuring windowless design with fluorescent daylight illumination sweeping every part of the working area. This plant has three separate buildings—the machine shop, the strip mill, and the casting and silver plating department. The strip mill is built adjacent to a corner of the main building within easy reach of the automotive bearing department. The casting department is adjacent to the one end of the machine shop for ready access to the aircraft bearing machine shops.

An excellent touch of modernity in the machine shops

Single Flange Front Main Crankshaft Bronze Bearing

OPERATION	EQUIPMENT
Rough bore, counterbore & face 1 end, Finish, bore & chamfer, rough turn OD Body & Flange, rough face inside	1A Warner & Swasey Lathe
Face of flange & end & break edge OD both ends, finish turn OD of body & flange, finish face inside face of flange, turn 3 annular grooves & face end, counterbore & break edge OD.	Sundstrand Automatic Stub Lathe
Cast (see casting method #1)	#3 Gisholt Lathe
Cut on end plug & break edge OD.	
Round	
Cut off excess stock flange end, rough turn OD of flange, bore, face & chamfer ID.	#3 Gisholt Lathe
Inspect for porosity	
Rough turn OD body & flange, face inside of flange & end.	8" Sundstrand Automatic Stub Lathe
Rough chamfer ID & break edge OD small end, break edges flange OD.	
Finish turn OD of body, finish face inside face of flange and end, chamfer ID.	8" Sundstrand Automatic Stub Lathe
Finish turn flange, undercut & break edge OD flange	8" Sundstrand Automatic Stub Lathe
X-Ray	
Finish grind inside face of flange, undercut & rough grind OD of body	Norton Grinder
Rough grind OD to size	Cincinnati Centerless Grinder
Finish, face & chamfer. Break edge OD & Burr polish small end	South Bend Lathe
Finish bore	Heald Borematic
Finish grind Clevite face	Heald 22 Grinder
Finish chamfer ID & OD Burr polish edges	South Bend Lathe
Mill 3 oil grooves	K & T Milling Machine
Blend oil grooves	Bench
Semi-finish Grind OD	Cincinnati Centerless Grinder
Finish Grind OD	Cincinnati Centerless Grinder
Burr	
Wash	
Inspect	
Etch	
Inspect	

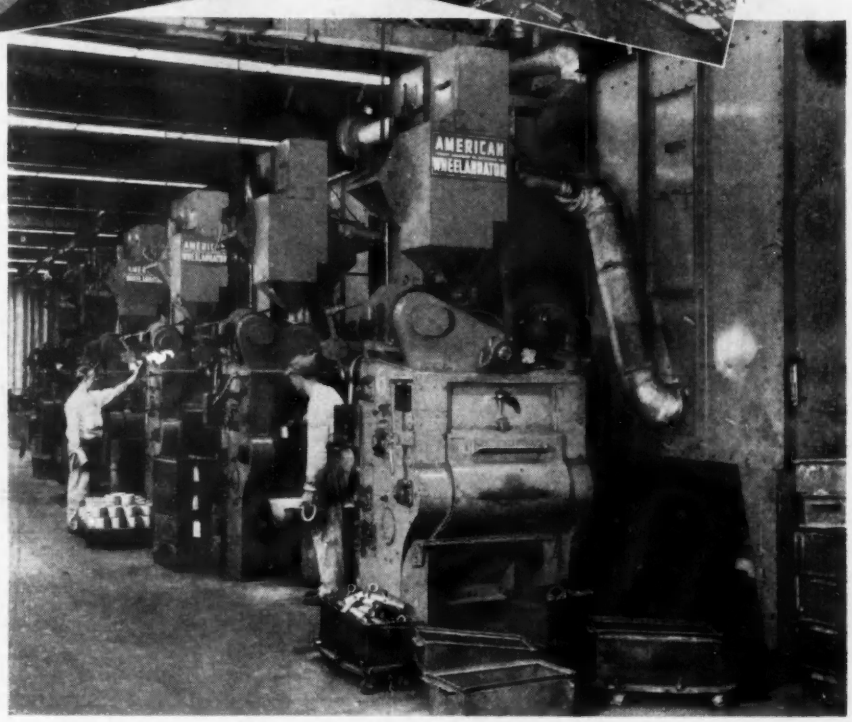


is the installation of bus duct for the distribution of power to every part of the building. This makes for better housekeeping by cleaning up the overhead system of wiring to each machine; also simplifies the problem of moving machines from one location to another or the introduction of new machines at will simply by plugging-in at the nearest connection in the bus duct.

Wherever possible metal cutting is done with cemented-carbide tipped tools for steel cutting and for machining white metal, copper-lead, or silver linings. Cemented-carbide tipped fly-cutters also are used on the precision boring machine. Further extension of this procedure is being studied constantly.

Machine Shops

Flexibility of machine shop operations has been greatly facilitated by the selection of the minimum number of makes and types of production equipment. For example—the major part of turret lathe work is done on several types of Warner & Swasey machines, supplemented by a group of Gisholt lathes for secondary operations. The bulk of turning and facing operations is done on Sundstrand automatic Stub lathes. Certain specialized detail operations are handled on the versatile South Bend lathe. Cincinnati Centerless grinders are employed for rough- and finish-grinding of outside diameters. Norton grinders are used exclusively for OD grinding. Heald More-Matics are employed in the aircraft department for precision-



(Above) Details of indexing fixture on a Kent-Owens miller for milling oil grooves.

(Above at right) Sundstrand Automatic Stub lathes are employed for the turning of bearing shells.

(Right) Perspective view of a battery of American Wheelabrator units installed in the casting department for cleaning bearings after casting.

(Left on facing page) Flanged automotive type bearing shells are formed and squared in this huge Bliss press.

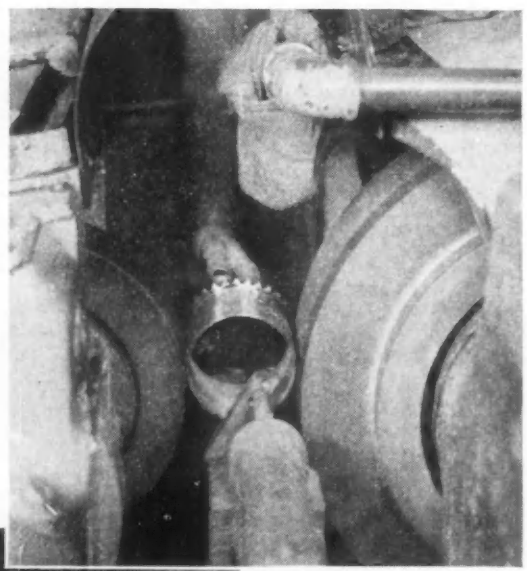
(Extreme left on facing page) View in casting department—pouring of bearing metal in Ajax induction furnace.

grinding of bores in bearings and bushings; Heald rotary grinders are used for grinding faces of bearings.

Slots and grooves for oil passages are milled on Kent-Owens automatic mills and on Kearney & Trecker mills. Fellows gear shapers handle the cutting of serrations. Baker heavy-duty drill presses are used for drilling and tapping while a large battery of the versatile Delta drills is employed for drilling fine holes.

Several of the large Footburt vertical surface broaching machines are set up for the broaching of slots and castellations on various parts. One of these is provided with fixtures and tooling for four different types of jobs. In each instance they employ an automatic tilting-and-indexing fixture with hand feeding and unloading.

Andrew C. Campbell abrasive cut-off machines have been adapted for several interesting operations. For one thing, a battery of these machines is found in the casting department where they are used for cutting off the ends of shells prior to cleaning castings for the machine shop. In the machine shop, one of these cut-off machines cuts bushing blanks.



Several equipment details are worthy of special mention. Here for example, is a Heald Bore-Matic set-up for boring and facing flanged bushings having a tapered neck at the flange. The amount of metal removal is so slight that the entire operation is dependent upon maintaining the thickness of the bearing lining from the parting line at the bond. For this purpose, the machine is fitted with an eye-piece micrometer, through which the operator sights the parting line and chucks the bushing accordingly with precise alignment. Another interesting Heald set-up is the cam-boring machine which automatically bores a double-taper bore in cer-

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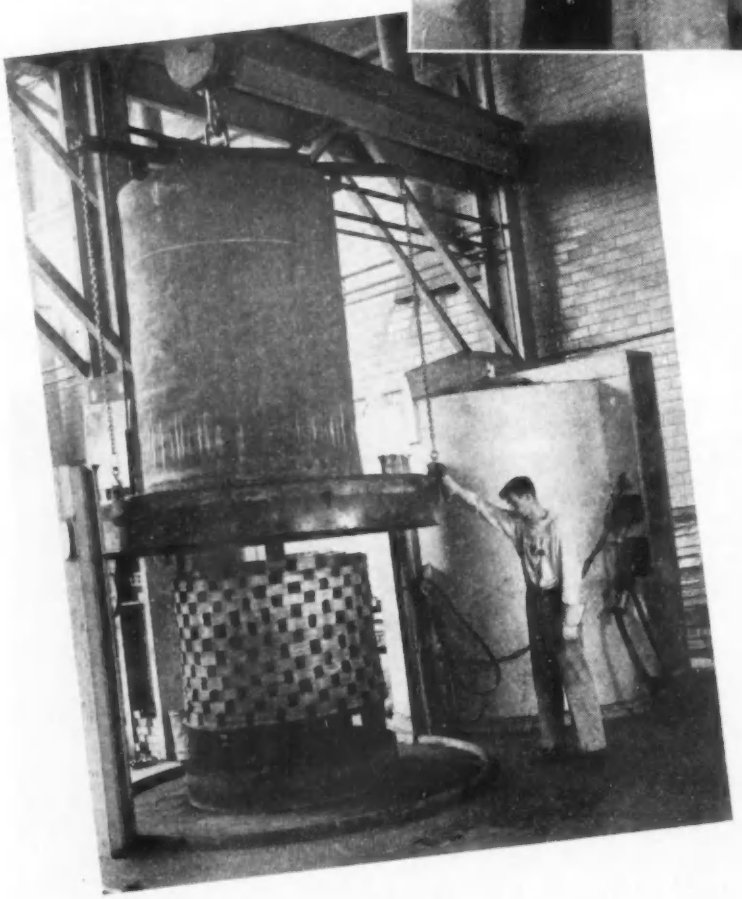
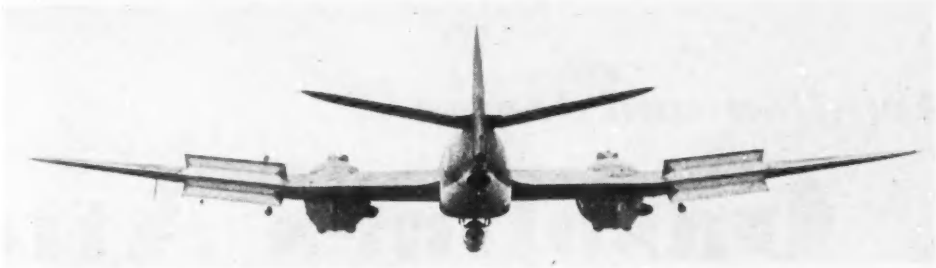


(Above) One of the Westinghouse electric annealing furnaces in the strip plant.

(Top) Close-up of Cincinnati Centerless grinding station showing the finish-grinding of aircraft bearing OD.

Single Flange Bronze Bushing

OPERATION	EQUIPMENT
Cut shell into two pieces	Campbell Abrasive Cut-off Machine
Hogout excess Clevite, turn OD flange. Face rough bore, chamfer OD & ream	Warner & Swasey Lathe
Inspect for Porosity	Bench
Rough turn OD of body & flange. Rough face. Face flange & end	Sundstrand Automatic Stub Lathe
Finish turn OD of barrel & flange, undercut, face end & break edge outside flange face	Sundstrand Automatic Stub Lathe
Finish grind inside face of flange & undercut, rough grind OD body	Norton Grinder
Finish grind small end	Heald 22 Grinder
Finish chamfer OD small end, break inside edge of flange OD break edge ID small end & burr, polish	Oster Lathe
Finish bore, chamfer & face Clevite	Heald 48-A Boremastic
Break outside edge of flange OD & burr, polish ID & OD flange end	Oster Lathe
Mill 4 grooves in flange face	Kent-Owens Mill
Semi-finish grind OD body	Cincinnati Centerless Grinder
Finish grind body OD	Cincinnati Centerless Grinder
Burr grooves on flange face	Bench
Burr complete	Bench
Wash & oil	Washer
Inspect	Bench
Etch	Bench



Rear view of a torpedo-carrying Beaufighter in flight with air brakes open and torpedo slung beneath the fuselage. Incidentally, from this aspect the pronounced tailplane dihedral, a relatively new feature of the Beaufighters used for all types of service, is clearly apparent. (Photo by courtesy, The Aeroplane, England)

Air Operated Dive Brakes on Torpedo Carrying Beaufighter

THE Bristol Beaufighter as a torpedo-carrier gives this ubiquitous aircraft yet another role. In this sphere its successful use has been immensely enhanced by the provision of dive brakes that are novel in respect of both design and operation. They enable the maximum speed of approach to the target to be maintained until immediately prior to the launching of the torpedo and the speed to be rapidly and greatly reduced before the missile is actually released.

Originally conceived as a long-range day fighter, armed with four 20 mm. cannon and six .303 in. machine guns, a speed of over 330 mph in level flight and a range of 1500 miles, the twin-engined Beaufighter has proved to be a formidable weapon on many fronts. Used later as a night fighter it has taken a major part in the defense of Britain. Later again it served well as an enemy convoy strafer, then as a bomber carrying two 500 lb. bombs and now as a torpedo - carrier. In the latter capacity its maximum speed at sea level with the torpedo attached is reduced to approximately 300 mph.

Although, for obvious reasons the highest possible speed of approach to the target is highly desirable, it is also of great importance that during the few moments prior to launching its load a torpedo-carrying aircraft shall be reduced in speed to the utmost. For reasonably accurate timing and aim it is generally considered that the maximum speed of launching should be within 175-180 mph. To this end the Beaufighter is equipped with what may be termed bellows or concertina air brakes, developed by the aircraft manufacturers, the Bristol Aeroplane Co. This special equipment is shown in the accompanying photographs.

Extending below the wing on each side is a horizontal venturi tube with an oval tube leading upward from it at right angles. The oval tube leads to the interior of a pair of "bellows"—the air brake flaps—one section of which is above the wing and the other below, with concertina type ends. Within the rear end of each venturi tube is a butterfly throttle controlled by the pilot. During normal flight the throttle is kept open and the air passing through the venturi tube gives rise to a partial vacuum within the bellows, drawing the brake flaps flush with the wing surface. The flaps on the upper surface are also restrained from involuntary opening, in addition to the effect of airflow over the wing, by strong concealed springs.

To bring the air brakes in action the venturi tube throttles are closed, thereby causing air pressure to fill the bellows and extend the brake flaps. Tension wires are fitted to limit the

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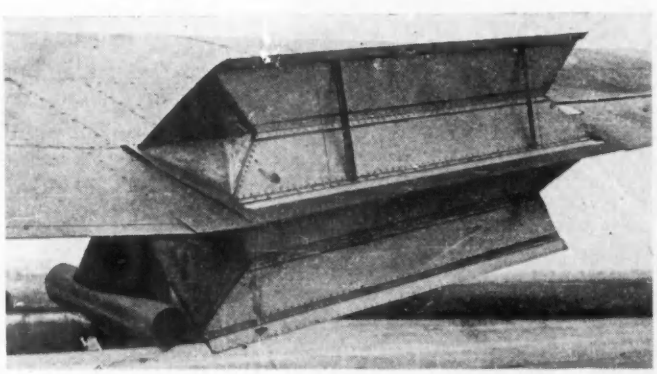
By M. W. Bourdon

Special Correspondent of AUTOMOTIVE *and* AVIATION INDUSTRIES in Great Britain



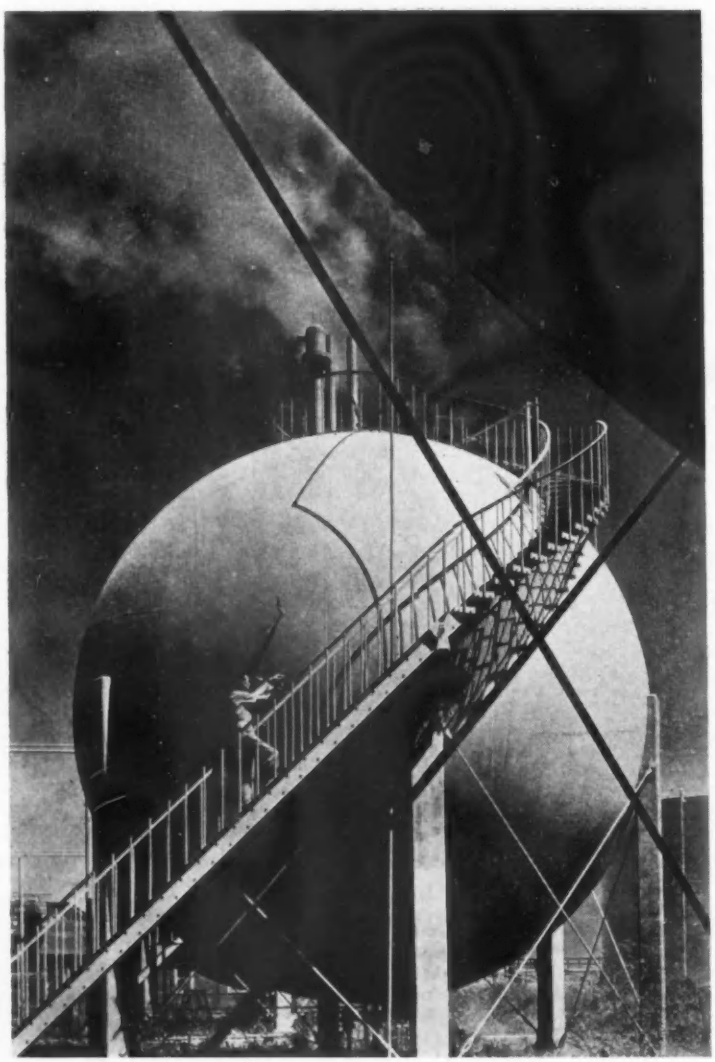
Close-up of venturi tube and air brakes of Bristol Beaufighter in open position. Upper flap as shown here is propped open by temporary struts, for it is not possible to open it normally while the machine is grounded. (Photo by courtesy, The Aeroplane, England)

Aviation and Motor

Gasolines After the

THE war program for making 100 octane aviation gasoline has required resorting to every expedient to obtain maximum production from existing equipment and new equipment under construction without regard either to ordinary refining economics or the extravagant use of crude. There is a school of thought which has held that, as the demand for aviation gasoline is reduced with the cessation of hostilities, the unwanted part of the 100 octane gasoline to be used as such will be blended more or less directly into motor gasoline. Persons who look on the matter this way feel that, in the postwar period, refineries will simply, in effect, sell as much 100 octane gasoline as they can and pour the rest of it back into motor fuel. There is another school of thought which believes that American ingenuity and technological advances made during the war will be translated very rapidly after the war into power plants for civilian automobiles which will incorporate the features of airplane engines and which will demand 100 octane fuel.

Most probable in the immediate postwar period neither of those things will happen and the actual result will be a compromise. It appears that, since no new automobiles are being manufactured and since millions of cars will be available after the war which cannot use 100 octane fuel to any real advantage, the public simply will not be able to afford to pay the price for a superfuel. Further, it appears very certain that when passenger car production is first resumed, it will be upon the basis of continuing the 1942 models, at least as far as mechanical features are concerned. In addition, in the event that substantial increases in economy are desired by the purchasing public, several other design avenues offer more promise than does the simple increasing of compression ratio with its attendant high octane number fuel requirements. It therefore seems quite improbable that there will be any substantial early demand on the part of motorists for 100 octane gasoline. It may be that, some time long after the war, engineers will produce power plants which will operate effectively on 100 octane gasoline; but even so, for an appreciable number of years to come, the automobile's diet will be determined by the digestion of the older model cars and the pocketbooks of their owners.



It appears quite definite that the production of 100 octane gasoline must take a sharp and early drop as soon as the peak military demand is passed. The emergency of war has necessitated the forcing of every possible available unit to its utmost capacity and the

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This article is an abstract of the paper, "How Will the 100-Octane Aviation Gasoline Program Affect Postwar Motor Gasoline?" which was presented Dec. 2 at the SAE Metropolitan Section meeting by Mr. Brown, assistant deputy administrator, Petroleum Administration for War, and Mr. Barnard, a consultant of PAW who is assistant director of research and development, Standard Oil Co. of Indiana. Mr. Brown formerly was director of that department.

War

taking of stringent measures which in many instances are quite uneconomical. As soon as the Government ceases to be a willing buyer for 100 octane gasoline, regardless of cost, and as soon as diminishing demand brings again into play the old law of supply and demand and brings about a return of a "Buyers' Market," the reduced market for high octane number gasoline will be supplied from low cost production units.

Emergency Production of 100 Octane Gasoline

As an illustration of the ephemeral character of much of the 100 octane gasoline produced during the early stage of the war, it should be appreciated that the petroleum industry in "lifting itself by its bootstraps" to produce greatly increased quantities of high octane aviation gasoline without having completed its new manufacturing facilities, of necessity, had to operate almost all of its refineries as if they belonged to one organization. This was done under the guidance and authority of the Petroleum Administration. In this operation components from East Chicago, for example, were sent by tank car to Philadelphia to be blended in 100 octane gasoline; components from Whiting, Ind., were sent to Texas, and isobutane available on the East Coast was shipped by pressure tank car to the West Coast. These operations, however, extravagant both in operating and transportation cost, practically saved the day for our Air Forces. Obviously, they could not be continued in peacetime if for no other reason than that the anti-trust laws would prevent it. In order to be entirely clear on this point, it should be definitely stated that a great deal of 100 octane production which this country was making available by the middle of 1943 was wartime emergency production which will continue only as long as the war and which will certainly stop immediately after the war.

The United States is not going to run out of crude for many years yet to come, but it is fairly evident to all concerned that our national crude oil position is rapidly changing from one in which we are producers of excess crude to one in which we will be required to import our marginal crude requirements. This change in position is apt to alter the fundamentals of our refining economics and will severly penalize those operations which do not use crude oil to maximum efficiency. The crude situation, therefore, will place much emphasis upon the desirability for shutting down as soon as possible after "V Day" those aviation gasoline manufacturing operations which are wasteful of crude.

By Bruce K. Brown and D. P. Barnard

How Much 100 Octane Gasoline Will Be Required For Aviation Use After the War?

If we assume that a five-fold increase in domestic airline fuel consumption will develop during the first five postwar years and that the use of aviation gasoline by other civilian agencies (including engine builders) will increase in like amount, we conclude that the total postwar civilian aviation gasoline requirement may be in the neighborhood of 50,000 barrels per day. It may be that the bulk of this business will continue to use the familiar more economical 91 octane grade currently used by the airlines. Postwar military demands are, of course, almost impossible to predict. Prior to the emergency, they accounted for scarcely 5000 B/D and just before Pearl Harbor had risen to something less than 30,000 B/D. If we assume that such demands will rapidly drop at the conclusion of the war to about 50,000 B/D, we would still be operating at about ten times the pre-emergency level. This fuel will, of course, fall in the highest octane number category and in all probability will be better than the

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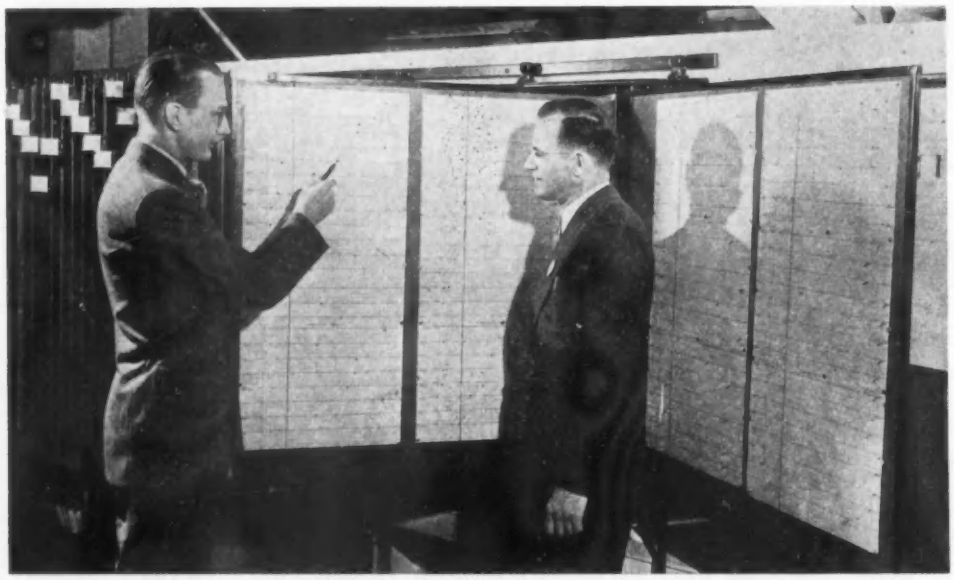


A master set of schedule boards provides the Vultee management with the daily production situation in all departments.

How

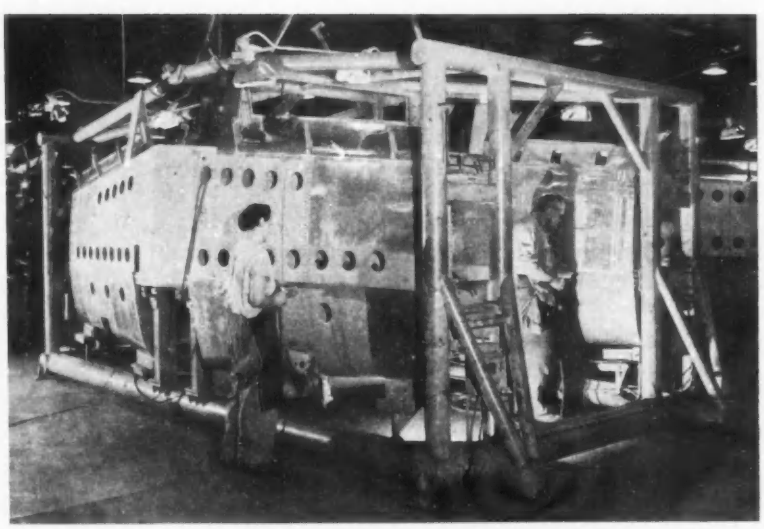
By W. V. McClung
Production Control Supervisor,
Vultee Field Div., Consolidated
Vultee Aircraft Corp.

SPRINGING suddenly from their regulated peacetime operations into mass production of warplanes for the United Nations, aircraft manufacturing plants, following the attack on Pearl Harbor, were faced with the problem of meeting highly synchronized schedules. Behind the story of the way in which they met this problem and mastered it is the story of production control, the functions of which brought to a reality the wide difference between manufacturing airplanes and building them. And there is a vast difference. A few years ago, airplanes were built like houses are built—piece by piece. Today, manufactured as a single unit and rolled out of factory doors by the thousands, American aircraft are hitting the enemy of every war front in this global struggle.

Basically the same throughout the entire aircraft industry, production control at Vultee Field serves as an example of efficiency in operation. A schedule must be developed to the nth degree. It must be broken down from final assembly requirements back through major assemblies, accessory assemblies and subassemblies to the actual part requirements, taking into consideration time elapsing for labor in the manufacture of the assemblies. The paramount function of production control is to see that schedules are met.

Before a schedule can be drawn up, all contracts are cleared first through the business office, where "master authorizations" are written covering the work to be performed. The Engineering Department plans, designs and builds the manufacturing tools, determines material requirements and establishes operation planning, all preparatory steps to production control. Material requirements then are forwarded to the Materiel Department, where the bill of material is prepared, quantities determined, material purchased and received into stock. It is then up to the Production Department to determine who is to make the part; i.e., whether it is to be manufactured at Vultee Field, contracted for manufacture by an outside firm, purchased as a standard manufactured catalogue article or provided by the customer. [The Government furnishes such equipment as instruments or armament.]

The unrelenting follow-up is maintained by means of schedule boards or pin boards installed in each assembly department. These boards comprise a complete list of assembly numbers and parts required for



Wing center sections are shown here in the master assembly jig which, after all operations are completed, serves as the carrier in conveying the center sections through the paint shop and to the Valiant trainer final assembly line.

Production Control Functions at Vultee

them over a given period, shown by dividing the board vertically into calendar days, where quantities are posted from inspection reports for that date. A marker moved daily sets forth the current date. Red push pins in proper day columns to left of the marker show any assembly order behind schedule. Blue pins to the right of the marker show production in advance of schedule.

Similar boards incorporating the information for all departments provide an over-all production picture for management, immediately disclosing any unsatisfactory conditions. The boards in addition to their informative value are a constant reminder that schedules must be met, because a delivery failure could be ruinous especially where mechanically moving assembly lines geared to minutes are employed as extensively as at Vultee Field, where they were first introduced in the aircraft industry, pioneered and developed to a high efficiency.

So that all personnel performing any work on an order may have all the information, shop orders are reproduced by the ditto process on tabulating cards directly from the master planning prepared by the Tooling Department. Fabrication orders for each detailed part are written and grouped in packets. A packet consists of a job progress folder (manila) enclosing a material reservation copy (white flimsy), stores issues (salmon flimsy), job assignment cards (pink) with one for each cost center, traveler (manila), which during fabrication is detached from the packet and remains with the material, a set-up card (green) furnished when specially trained personnel or special handling equipment is required and the blue or close-out card, which, when the packet is released to fabrication, is detached and remains in the office file until parts reach the finished

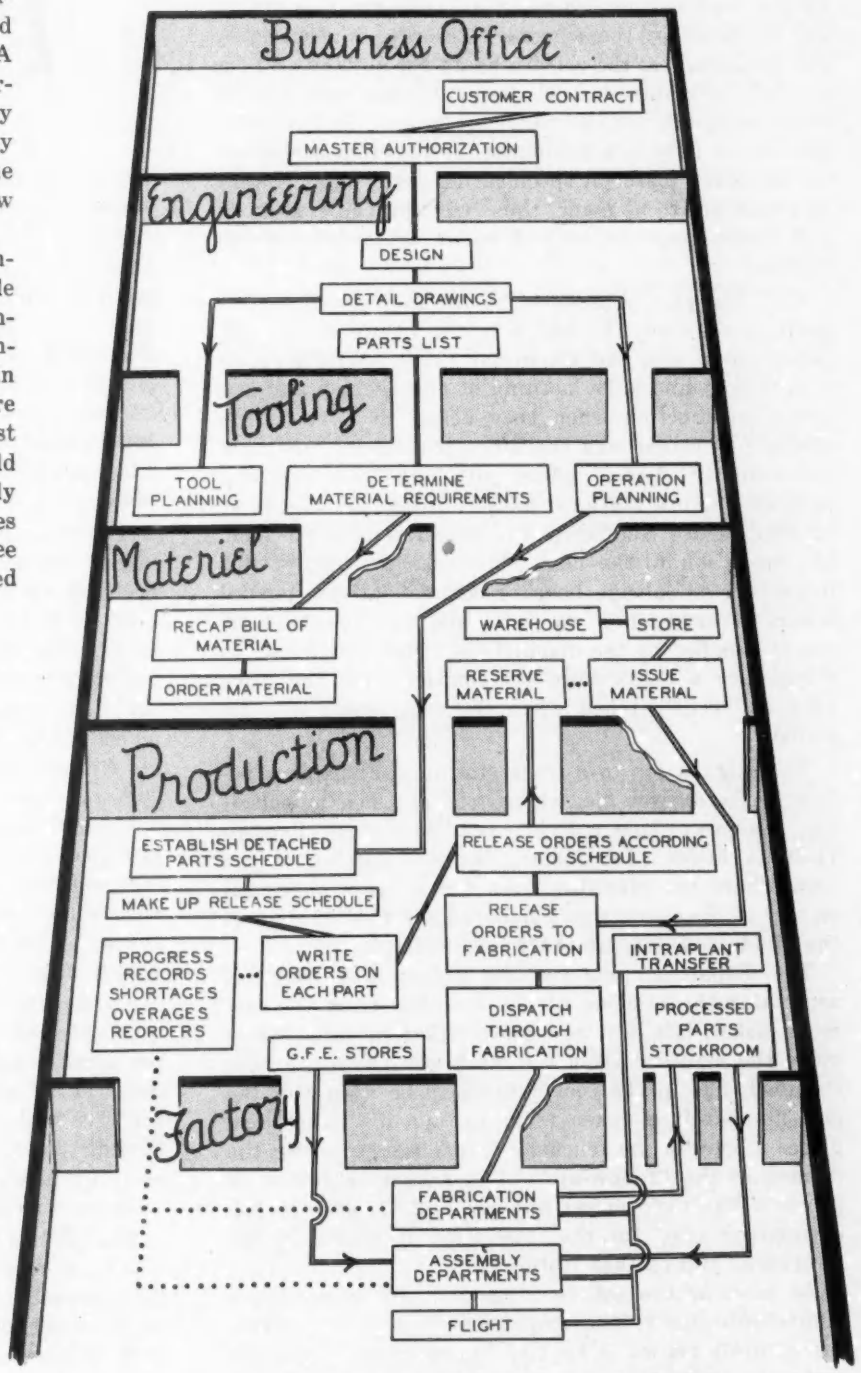


Chart of departmental functions and responsibilities at Vultee

stock. At that time the traveler is detached from the material and returned to the office, officially closing the order, the quantity of good parts accepted by the Inspection Department are posted on the master, the blue card cleared from the active file, date stamped and forwarded to the cost accounting department.

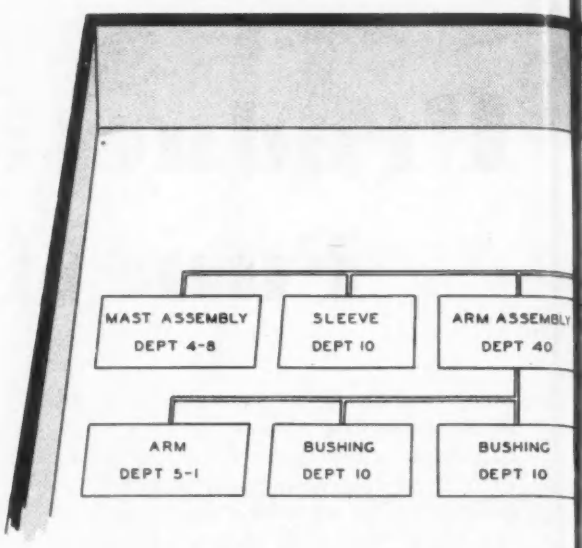
Thirty days in advance of shop requirements, orders are checked with material control in the Materiel Department by the production control office forwarding the white flimsy and salmon flimsy. Material is reserved and the flimsies stamped by material control, after which both flimsies are returned to production control, where they are then filed with the corresponding part orders ready for release to the proper fabricating department for manufacture. On the proper day as shown by the schedule, the order is released by the dispatcher at the release booth for cutting and the material is assigned, first from cull, then raw stock if there is insufficient cull to fill the order. In that mannear cull is kept to a minimum. If cut from raw stock, the standard material specification cards show exactly how cuts are to be made, thus reducing the amount of cull which could be caused by an inexperienced operator.

Until the part is accepted by the Inspection Department as finished, the job is in the hands of the dispatch group, many of whom had never seen the inside of a factory and knew nothing of engineering and airplane construction when they began to work. Simplicity of system was therefore mandatory. With a minimum of clerical effort jobs and tools are dispatched to work stations, tools returned to cribs after operations are completed and material ordered from one operation to the next. Reworks to comply with inspection or salvage board recommendations, partial orders if emergency warrants and tool break-downs are all handled by the dispatchers. Material for a job stopped by a break-down is removed from the work area and redispatched when the tool repair is completed.

To assign a job to a work station, a dispatcher refers to the drawer file, where jobs are filed by schedule. As an example, a divider may be tabbed: Presses 71-20 to 71-50. Job folders for jobs coming to the area where the planning calls for a press operation on any of the presses so numbered are filed in rear of the divider classifying the work stations.

The dispatcher removes the packet from the file, ascertains the location of the material from the last move ticket, fills in a new move ticket in duplicate to move the material from the work station to the next specified, fills in the tool number to be used and the crib number it is taken from, initials the ticket, and places a copy in the trucker's "out" box, dropping the flismsy in the "follow-up." The packet or folder he places in the rack pocket number 71-20-1, and the job assignment card for that operation is placed in the "working" clip on that station.

As soon as the job is completed and inspected, a signal indicates to the dispatcher it is to be moved. An accurate record is kept of the progress of the job and upon completion of a day's work, record cards are forwarded to the methods and controls department for



tabulating performance, cost center realization and standards compilations.

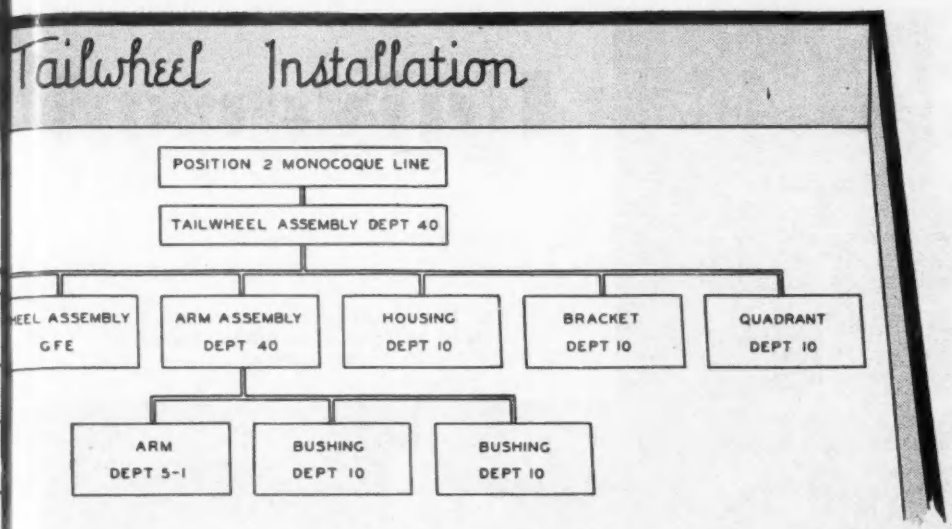
Allied with a successful dispatch system, careful consideration to plant layout is essential. The arrangement and placing of machinery, work benches, ovens and other equipment at Vultee Field provides for routing work through the Fabricating departments so that it will flow from one work station to another with no back track. Every work station has its designating number, whether a machine, furnace or a bench. Floor space for two jobs at each station has been provided.

The reason for always having a "working" and a "next" job at each station is clear. If a man is at his desk in an office and a friend asks him to play golf, he is more apt to cut loose and go if his desk is clean. But if his desk is piled high with papers, he is too busy to go. The same applies to a machine operator. He is working one job and another is waiting. There is evidence that he is busy. There's work to do. He's important, and rightly feels that importance.

As the last operation is performed in fabrication, the parts clear through inspection and receive the specified finish. All painting is done by spraying. The parts are spread on trays suspended from carriers on a mechanically moving conveyor line, travel through the drying ovens and emerge ready to be placed in processed parts stock.

Intra-plant transportation is another vital function under the jurisdiction of production control. That department is charged with the responsibility for movement of all material or parts between departments, the care and operation of all handling equipment including power trucks, hand trucks, skids, skid bins, stacking pans, caster trucks, flat trucks and specially-built equipment.

The central dispatch station is the clearing center, where all tow motors report, receive orders and are dispatched on their various missions. Regular routes on fixed schedules are laid out for "express service" with the materials or parts for interdepartmental moves being concentrated in the department depots, where they are picked up and moved according to



Assembly breakdown chart for Valiant basic trainer tailwheel

schedule. "Moves" which cannot be hauled by the express service, such as unloading engine crates or changing the two-ton dies used on the larger presses, are dispatched by individual orders.

The Assembly departments at Vultee Field are divided into four main divisions — sub-assemblies, accessory assemblies, major assemblies and final assembly. Each assembly department is arranged into separate cost centers. In the case of sub-assemblies and accessory assemblies, these cost centers consist of production lines which have been set up after analysis of the operations on similar parts. The analysis indicates what groups of assemblies follow the same general sequence. The machines, benches, and equipment are then set up to follow this sequence. The parts to be assembled when ordered out by the dispatcher are issued by process parts to the department, move forward from one assembly operation to another either on conveyors or specially designed handling equipment until they emerge as completed parts.

As the finished assemblies come off the end of the line, they pass through an inspection station The cost center is used for accounting as well as production control purposes and the actual time is compared with standards to insure steady, uninterrupted production flow. In Major and Final Assembly departments, each major assembly jig or production line is set up as a cost center and provision made for recording production and measuring against standards similar to the sub-assembly lines.

The operation planning provides a bill of material for approximately one week's production specifying the quantity of each part required at each station, one copy of which goes to the stock rooms as authority for issue. All material is delivered to its proper cost center when called out by the production dispatcher who is responsible for having it where it will be used when required.

Standard times have been established to indicate the amount of time allotted to complete each assembly. Based on these standards, the number of personnel in each cost center has been definitely established. To insure quality of workmanship, work in operation centers and in all complete assemblies must be accepted by the inspector before it can proceed to the next operation center or assembly.

An illustration of the construction of the center section of the BT-15 Valiant trainer will show the flow from sub-assemblies to final assembly. The main beam and nose section are built in sub-assemblies and combined into one major assembly. Simultaneously paralleling this operation, the outer and inner panel sections, which contain the gas tanks, are constructed. At a further point down the line, the rear spar section is placed on these outer and inner panel sections which produce the intermediate panel section. Two of these intermediate panel sections are joined with a main beam and nose assembly in a master assembly jig, which is the start of the center section's travel down the conveyor assembly line. Here, all assembly operations are balanced into equal time cycles with a crew at each station performing certain regular items of work arranged in progressive sequence. After all the operations are finished along the major assembly line, the center section, suspended by the jig serving as a carrier, travels on the conveyor through the paint shop and to the final assembly line.

The same progressive system of assembly pictured by the flow of the center section is also used on the outer wing assembly, fuselage assembly, and accessory assemblies, which includes engine assembly. All are mated in final assembly to form the complete airplane as it progresses down the precisely-moving mechanized conveyor line, to be towed onto the field, serviced, tested and flown away.

Dive Brakes on Beaufighter

(*Continued from page* 25)

travel of the upper flaps on each side, this being in the area of negative pressure. For take-off, the lower sections only of the bellows air brakes are used, operated by separate manual control. In landing the lower part of the air brakes and the ordinary split flaps are brought into effect in combination.

As will be realized, an important advantage of this system of dive brakes is its simplicity. With both opening and closing effected by air pressure due to the motion of the aircraft, no auxiliary power unit—such as an hydraulic servo—is required to operate the brakes.

With a torpedo attached the all-up weight of the Beaufighter is increased, relative to the standard fighter, from 21,000 lb to 25,000 lb. Stalling speed is said to be around 80 mph, and, despite the wing loading of about 50 lb per sq. ft., the machine carrying a torpedo clears a 50 ft. obstacle with a run of 2250 ft.

Universal

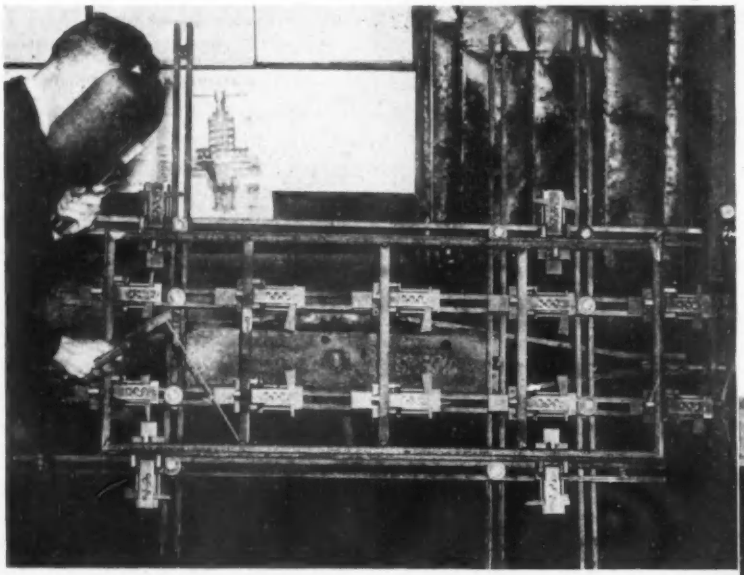


Fig. 1—General view of the universal welding jig with table tilted.

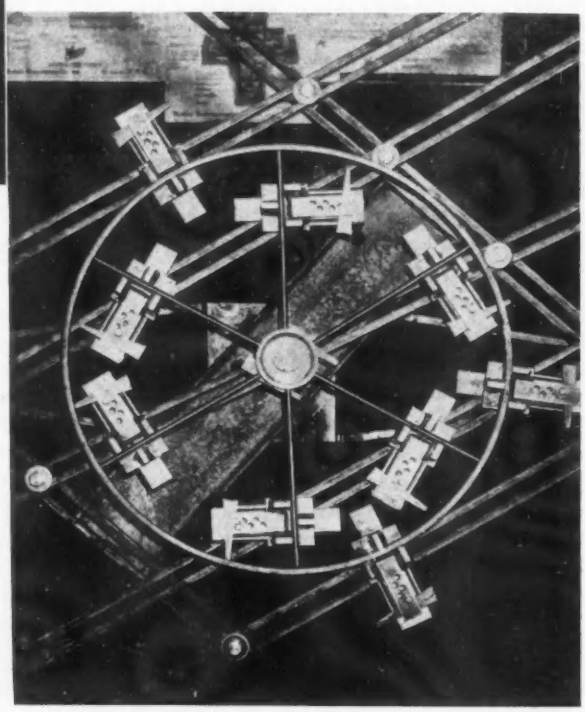


Fig. 2—Showing two pairs of bars welded to table and others bolted to the former.

WITH the recent rapid progress in welding and the diversification of its applications, methods of holding the work have become a major problem. The jig, generally thought of as a single-purpose holding device, is designed to hold one job or type of job with very little, if any, variation, and efficiency in carrying out the operation generally is the sole aim in its design.

Edwin J. Freeman, head of the Industrial Engineering Dept. at Clemson Agricultural College, has done considerable experimental work in an attempt to develop a jig for holding various small bar and structural shapes in position for welding. Such a jig can be very simple if it is to be a single-purpose device. But in the design of the jig described in this article, an effort was made to combine the advantages of the universal type with those of the single-purpose device and to keep the cost within reach of the small fabrication plant and even the general welding shop. It is the final result of a series of experimental designs which was started in September, 1940. The aim was to develop a jig which would incorporate the following desirable features:

(1) Adaptability to varying requirements.
(2) Quick adjustment or set-up of the jig itself.
(3) Quick set-up of work in the jig.
(4) Low cost of construction.
  (a) Use of standard structural shapes.
  (b) Minimum of machine tool requirements.
  (c) Minimum of operations.
(5) No screw threads or parts exposed which can be injured by spattering.

Fig. 3—Set-up for welding a mitre joint.

Welding Jig Clamp

Data and illustrations in this article are from a study submitted to The James F. Lincoln Arc Welding Foundation by Mr. Freeman in the Foundation's $200,000 Industrial Progress Award Program for reports and advances and improvements made by the application of arc welding in design, fabrication, construction and maintenance. A total of 408 awards was made for outstanding papers submitted during the 2½-year welding study.

The complete universal welding jig consists in the main of two parts, a tilting and rotating table, and clamps attached to the table for holding parts to be welded. This type of table has been in use for a number of years, and this article is really concerned only with the clamping device, hereinafter called the clamp. Fig. 1 shows the table tilted, and the general construction. A bolt passing through slots in two bars of ½ by 1-in. flat steel holds the clamp in an adjustable position. The two vertical pairs shown are of ½ by 1½-in. steel, and only these are welded to the table. The others are bolted to the welded bars and may be of any length to suit the set-up. Since the clamps can be rotated and fastened at any angle, all bars can be fastened across these two main bars and adjusted to any position. This is shown in Fig. 2.

To aline tubing for welding, the row of clamps is tightened on a straight edge, whereupon the nuts on the slot bolts are tightened. This alines the stationary jaws. The clamps are released and the straight edge is removed. The clamps are thus alined for any size pipe up to the limit of their capacity. Fig. 3 shows a set-up for a mitre joint. A framing square is used to aline the clamps.

Where a finished job is to be copied, the clamps are placed in approximate position by arranging the slot bars on the table and the clamps in the slots. The master job is placed in the clamps and the jaws are tightened. The nuts are then tightened, holding the slot bars and clamps in position. The clamp jaws are released, the master is removed, and the jig is ready to hold the parts in position to be welded.

An assembly drawing of the clamp is shown in Fig. 4. The clamp has a capacity up to 2 in. It consists of two main units, the base and the movable jaw. The piece to be held is placed between the jaws, and then the movable jaw is moved to the left. Pin 12 is placed in the proper hole, and wedge 13 tapped with a hammer to tighten the jaw. To remove the work, the wedge is tapped back, but the pin and wedge remain in position for the next job to be held.

The holes for stop pin

(*Turn to page* 88)

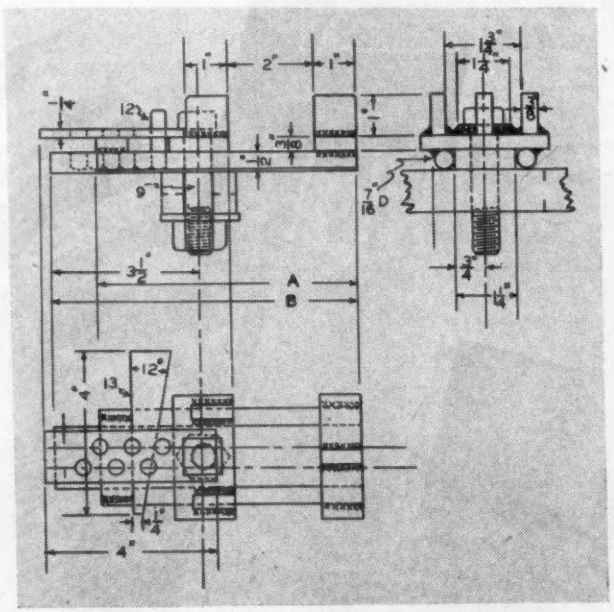


Fig. 4—Universal welding-jig clamp.

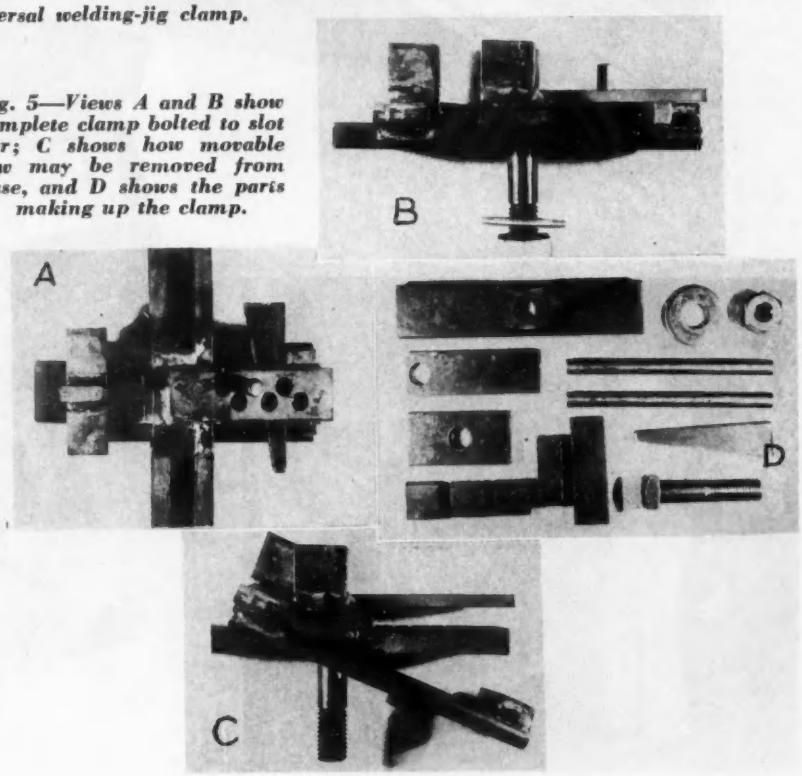
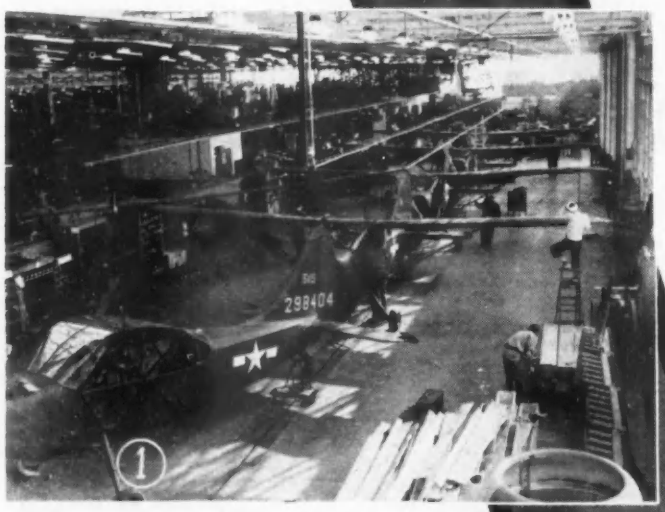


Fig. 5—Views A and B show complete clamp bolted to slot bar; C shows how movable jaw may be removed from base, and D shows the parts making up the clamp.

Flying

By Joseph Geschelin



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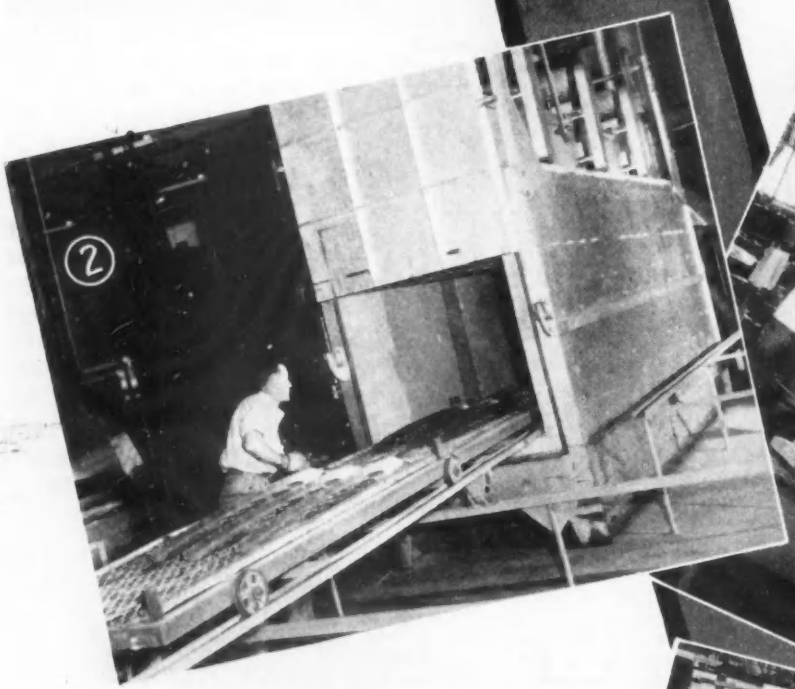

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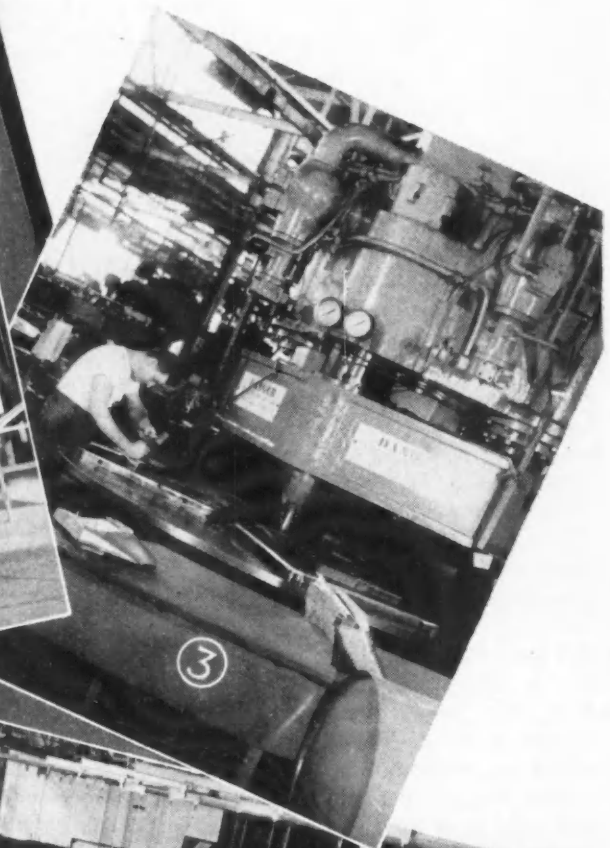

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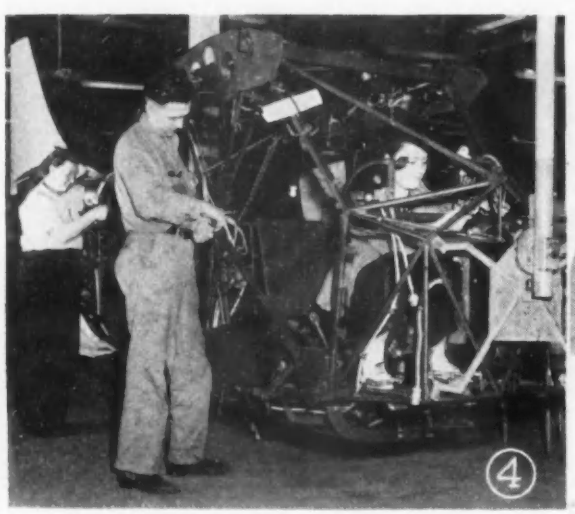


4

5

Jeeps on the Production Line

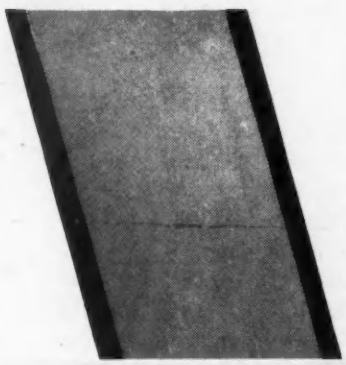
SERVING as the "eyes" of the Army's ground forces in the field, the Stinson Sentinel or "Flying Jeep," as it is more popularly known, has made an outstanding record of performance according to current reports. Its stability and maneuverability, coupled with remarkably low speed hovering ability, make it admirably suited to the functions of reconnaissance, liaison and for directing artillery fire.

Designed and produced by the Stinson Division, Consolidated-Vultee Aircraft Corp., the Flying Jeep has undergone intensive engineering development in the direction of simplification of every element of construction so as to facilitate ease of maintenance in the field. And yet, despite its lightness and simple design, the ship is extremely rugged and features a high factor of safety in all stressed members.

Flying Jeeps are built today in a compact and modern manufacturing plant which employs, on a small scale, the same advanced production methods as are found in the largest airframe plants in this country. Manufacturing procedures stem from production break-down techniques of the latest type. Mechanization has been developed to the maximum degree consistent with the size of sub-assemblies and assemblies and in line with current production rates.

Owing to relatively limited facilities, many of the components such as the wings and flaps are made by outside sub-contractors. However, the fuselage, wing assemblies, and final assembly are handled here in their entirety. In keeping with modern practice, the plant is equipped with the familiar Bull-Dog power duct for the distribution of power to machinery and to the portable tools. Fluorescent lighting, providing excellent "seeing" is in evidence throughout.

1. *For final assembly stages, the Flying Jeep is removed from the overhead line, fitted with landing gear, and rolled on its own wheels on the floor conveyor shown here. The ship at the extreme left marks the first station on this line, assembly operations being handled with ships moving tail end first into the background. Installation of wings takes place at the next station.*



2. *One of a battery of Lindberg furnaces in the press shop for heat treating and quenching light aluminum stampings.*

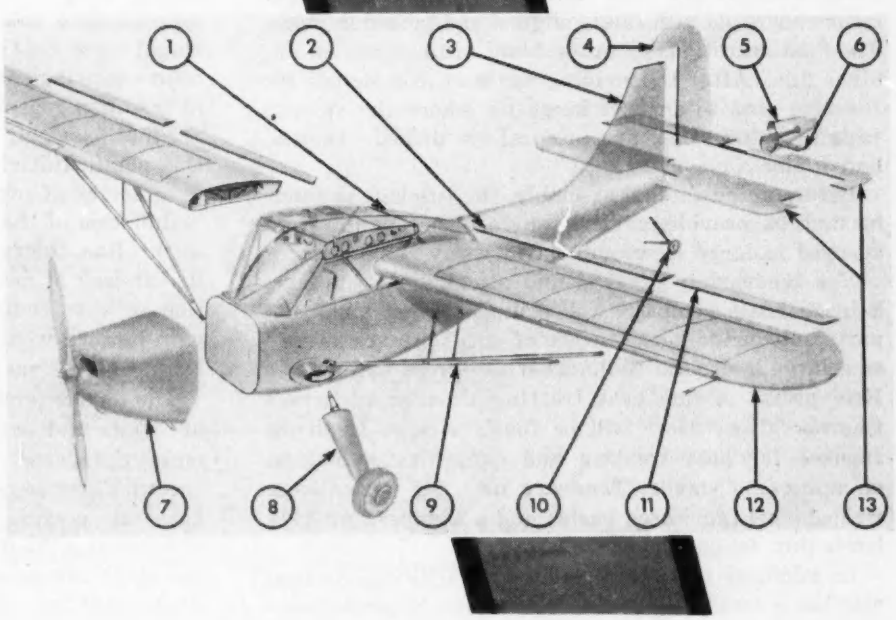
3. *Close-up of Williams-white hydraulic press fitted with rotary indexing table accommodating three sets of dies for the production of various stampings. Adjacent to this press is a large Lake Erie hydraulic press*

4. *Prior to application of fuselage coverings, the assembly, as shown in the overhead suspended trunnion fixture, is completed as to wiring harness, electric connections, etc.*

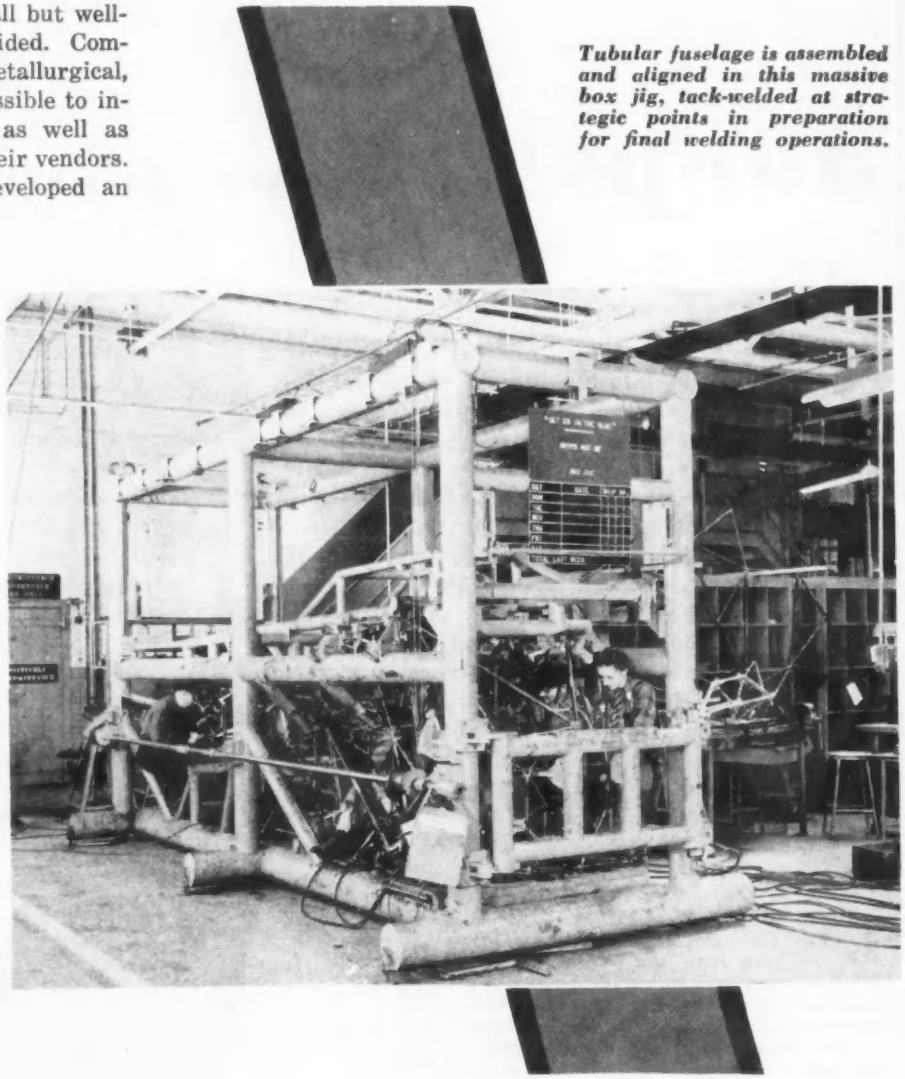
5. *Here is the first stage of final assembly with the fuselage suspended from ceiling-mounted rails. One of the major operations is installation of the Lycoming powerplant.*

Production break-down drawing of the Flying Jeep, indicating the major sub-assemblies from which the ship is integrated.

1. Fuselage
2. Flaps
3. Fin
4. Rudder
5. Tail cone
6. Trim tab
7. Power plant
8. Landing gear
9. Struts
10. Tail gear
11. Aileron
12. Wing
13. Horizontal surfaces



As a watch-dog on quality, a small but well-equipped laboratory has been provided. Complete equipment for chemical, metallurgical, and mechanical testing makes it possible to inspect all incoming raw materials as well as castings and forgings supplied by their vendors. In addition, the laboratory has developed an excellent setup for trouble-shooting on the gamut of problems in the plant and in the field. This organization also is charged with the responsibility for welding research and the qualifications of production welders.



Tubular fuselage is assembled and aligned in this massive box jig, tack-welded at strategic points in preparation for final welding operations.

It may be noted in this connection that all of the welding on the tubular fuselages and the tubular wing truss for British Navy trainers is done by arc-welding. For this purpose they have a large battery of the portable Harnischfeger P-H arc-welding units. In the sheet metal fabrication department spot welding is handled on a battery of new Taylor-Winfield Hi-Wave resistance welding machines.

To touch briefly on some on the highlights of production facilities, consider first the fuselage department. The fuselage is of tubular construction. Initially, it is broken down into small sub-assemblies which are mounted in jigs on welding positioners to facilitate the development of sound, strong arc-welded joints. Subsequently, the assembly is integrated in a huge framing jig of massive tubular construction where all of the sub-assemblies and tubular members are accurately aligned and tacked in place. The final operations of arc-welding are handled on another line. After the welding has been completed, the fuselage goes to another large jig where the various fastening locations are accurately drilled, tapped, bored, etc.

Before going to final assembly, the fuselage is sand-blasted to provide a clean surface for paint, then sprayed in large Newcomb-David spray booths.

For the variety of steel and aluminum stampings, Stinson has a compact, well equipped sheet metal department, including a variety of small presses as well as a large hydraulic Williams-White press and a Lake Erie press. A fine heat treating department serves this operation. Here will be found a large Lindberg furnace for heat treating and quenching aluminum stampings; a smaller Lindberg unit for normalizing welded steel fabricated parts; and a Lindberg pit-type hardening furnace.

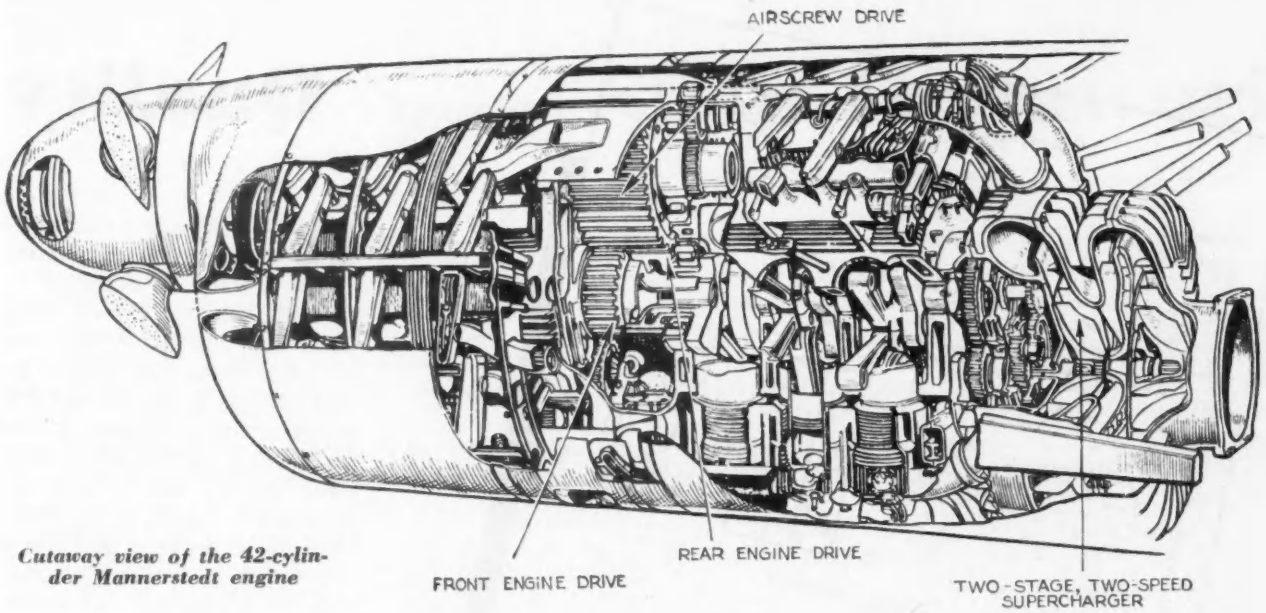
In addition to these press shop facilities, Stinson also has a small drop hammer shop and Kirksite foundry for the few deep drawn parts that are made here.

Wing fabrication and wing assembly are handled in a separate department. Fabricated wood wings for the Flying Jeep come in from outside vendors and are covered with fabric, and painted in large Newcomb-David spray booths. It is of interest to find that operations on wings are handled on short monorail sections in trunnion type fixtures.

Final assembly has been completely mechanized in this plant. Initial assembly of the fuselage is handled on a series of overhead monorails up to the point of installation of the landing gear and wings. At the end of this line, the fuselage is lifted on a portable hydraulic lift-jack of automotive type to permit the installation of the landing gear. Then the unit is lowered onto its own wheels and is hooked onto the floor drag chain of the final assembly conveyor.

The final assembly line takes care of the installation of wings and accessories and the other details that make the Jeeps ready for flight. A huge circular "growler" for demagnetizing the entire structure eliminates all possible interference with radio reception.

Adjoining the plant is a good-sized hangar in which the ships are given their final touches, modifications where specified, and inspection.



Cutaway view of the 42-cylinder Mannerstedt engine

Mannerstedt *42-Cylinder Aircraft* Engine

By M. W. Bourdon Special Correspondent of AUTOMOTIVE *and* AVIATION INDUSTRIES in Great Britain

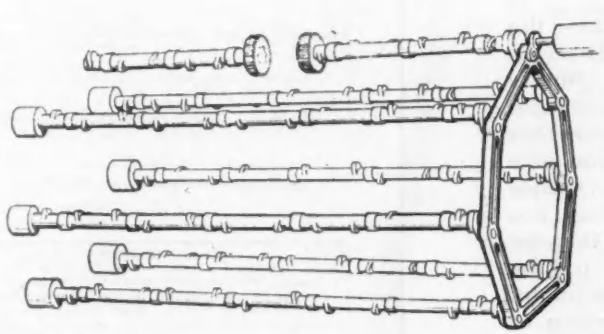
A SWEDISH engineer, Herr Folke Mannerstedt, describes in detail in *FLYG* (Stockholm) an aircraft engine he has designed. It is not stated whether it has yet been put into production, nor, if it has not, what its prospects are in that direction. But it embodies several interesting features, as well as being unconventional, to say the least, in its general layout and on that account is worthy of consideration at the present stage.

The engine consists of two units, each comprising three banks of seven air-cooled radial cylinders, making 42 in all. The front unit at its rear end and the rear unit at its front end are geared to a propeller shaft drive located between them. Behind the rear unit is a two-speed two-stage supercharger delivering air only to the cylinders, since the fuel system is the direct injection type. The accompanying views, drawn by a Swedish artist, are reproduced from *Flight* (London).

Mannerstedt, previously best known as the designer of the Swedish Husqvarna Grand Prix motorcycle engine, explains that he has adopted the two-unit arrangement in order to obtain better cooling and certain other advantages, among which is the reduced crankshaft torsion due to the drive being taken from the center instead of from one end of a long engine. Easier crankshaft production is another aim.

Mannerstedt Engine Data

Bore and stroke	4.331 by 4.331 in.
BHP (estimated)	2500
Frontal area	7.5 sq ft.
Length overall	6.25 ft.
Maximum dia.	37.4 in.
Piston disp.	2678 cu in.
Weight (estimated)	2100 lb.



Oscillating ring and crank drive is provided for six of the seven camshafts of the Mannerstedt engine. The seventh is driven directly from the propeller reduction gear, and gives motion to the oscillating ring by a crank at its rear end

The propeller shaft, located above the front crankcase, is hollow and has a bore large enough to provide for a 20 mm. or even a 37 mm. cannon firing through it. The cylinders are at an angle of 50 deg, excepting those on each side of the top center line, which are at 60 deg to give more room for the propeller shaft.

A novel design has been adopted for the drive of the camshafts (see illustration) in or-

(*Page* 71, *please*)

Quality

RYAN AERONAUTICAL COMPANY'S quality control system is designed to prevent factory errors from being repeated after they are first spotted by inspectors. In most factory organizations the inspection department must track down the cause of each error, decide how it can be eliminated, make recommendations for corrections, and check to see that the recommendations are followed. At Ryan the Inspection Department's responsibility ends when it finds an error and at that point the Quality Control Department takes over.

INSPECTION DISCREPANCY REPORT No. 1853

Assembly No. 21-100 Name Elevator Tab Bell Crank Bracket

PART NUMBERS IN QUESTION
21-100-74

Release No. 1 Quantity Inspected 1 (First Article) Released None

Quantity Sent Through Salvage 1 On Rejection Report No. 6749

EXISTING DISCREPANCIES

Hole "A" on print 21-100 is 5/16" plus .002 or minus .000. Operations Sheet reads "Drill 5/16", ream .316". Drill bushings in drill jig are 5/16" and bushings in reaming fixture are .316.

ACTION TAKEN BY INSPECTION

First article checked and sent to Salvage because hole "A" is reamed to .316 and, therefore, does not check to the 5/16" dimension shown on the print.

Machine Shop foreman notified of the discrepancy and operation stopped pending investigation by Quality Control.

Origin of Discrepancy Machine Shop Dept. Signed E. E. Gofer

The Tooling Dept. believed to be responsible for the above discrepancy. Signed S. A. Bowman

Date Reported August 2, 1943 INSPECTION OFFICE Date Corrected 8-2-43

QUALITY CONTROL DISCREPANCY REPORT

Dept. Tooling Attention Design Engineer Date August 2, 1943

The following discrepancies have been reported by the Inspection Department on their discrepancy report

Serial No. 1853 dated August 2, 1943

Assembly No. 21-100 Name Elevator Tab Bell Crank Bracket

PART NUMBERS IN QUESTION
21-100-74

Release No. 1 Quantity Inspected 1 (1st Article) Released None

Quantity Sent Through Salvage 1 On Rejection Report No. 6749

EXISTING DISCREPANCIES

Hole "A" on print 21-100 is 5/16" plus .002 or minus .000.

Operations Sheet reads "Drill 5/16", ream .316". Drill bushings in drill jig are 5/16" and bushings in reaming fixture are .316.

ACTION TAKEN BY INSPECTION

First article checked and sent to Salvage because hole "A" is reamed to .316 and, therefore, does not check to the 5/16" dimension shown on the print.

Machine Shop foreman notified of the discrepancy and operation stopped pending investigation by Quality Control.

Quality Control has investigated the above discrepancies and it is believed to be the responsibility of the Tooling Department to correct same.

RECOMMENDATIONS FOR CORRECTION

An investigation indicates that the fractional dimension 5/16" shown on the drawing was relayed to the Tooling Draftsman verbally and he understood that a .316 hole was required and the Operations Sheet was prepared through reference to the tooling drawing. Please correct tooling immediately.

Quality Control Department

(Above) Inspection Discrepancy Report

(Right) Quality Control Discrepancy Report

(Facing page) Reply to Discrepancy Report

These three forms are the originals of Inspection Discrepancy Report No. 1853, Quality Control Discrepancy Report and Reply to Discrepancy Report that were used in the correction of a tooling discrepancy. As shown by the reports the tooling was corrected the same day the discrepancy was reported to the Quality Control Department, which handles the correction of some 300 such discrepancies each month.

Control *through* Shop Teamwork

By Bert Holland
Quality Manager
Ryan Aeronautical Co.

Duties of the Quality Control Department are:

A. Investigate the causes of all rejections and employ the necessary measures to eliminate them.

B. Handle all salvage activities.

C. Point out and take steps to eliminate all unsatisfactory conditions which may become causes for rejections.

D. Cooperate with the Production Department in the development of more efficient and improved methods, to improve quality and avoid rejections.

E. Compile statistics to show financial losses and materials wasted as a result of rejections and poor manufacturing methods.

F. Assist sub-contractors and vendors in developing and maintaining the highest possible degree of efficiency from their inspection departments.

G. Cooperate with the Outside-Production Department in determining the qualifications of all subcontractors and other outside sources of supplies.

H. Ascertain and advise the Outside-Production Department whether or not outside sources are producing products which conform to Ryan standards of quality and workmanship.

I. Deal with customers on problems pertaining to the quality of work being done for them.

Clarification of Duties

All rejections are reported to the quality control office by means of an Inspection Discrepancy Report. Upon receipt of this report, a member of the quality control liaison staff conducts a thorough investigation to ascertain the nature of the discrepancy responsible for the rejection. Having determined the nature of the rejection, he then seeks to determine the exact cause of the discrepancy. Having found this, he prepares a Liaison Report to the Quality Manager, giving him all the details. The quality control office then prepares a Quality Control-Discrepancy Report, incorporating a recommendation for corrective measures, and addresses same to the individual or department responsible for the correction of the discrepancy reported.

All salvage activities are carried on by the Quality Control Department. For this work, a staff of salvage engineers and liaison men is maintained under the supervision of the Quality Manager. The salvage division handles all salvage cases which require the decisions of salvage or stress engineers.

Unsatisfactory conditions which may become causes for rejections are reported to the quality control office by members of the quality control liaison staff, by the Inspection Department and, in some cases, by production personnel. Upon receipt of such information, the Quality Manager conducts a thorough investigation, and then makes the necessary recommendations to the proper authorities to eliminate the unsatisfactory conditions reported.

The quality control liaison staff is constantly on the alert for inefficiency and out-of-date methods throughout the plant. Whenever these conditions are found to exist, they are immediately reported to the quality control office. The Quality Manager then makes a personal investigation. If more efficient methods to improve quality, avoid rejections, and expedite production can be applied, the necessary recommendations are made to the proper authorities without delay.

Statistics on financial losses and materials wasted as a result of rejections and poor manufacturing methods are compiled by the quality control statisticians. These reports are submitted to the Quality Manager daily. This information is transferred to bar graphs maintained in the quality control office. These graphs show the number of units accepted, the number reworked, and the number scrapped.

REPLY TO DISCREPANCY REPORT

To: QUALITY CONTROL DEPT.

Assembly No. 21-100 Serial No. 1863

Name Elevator Tab Bell Crank Bracket

PART NUMBERS IN QUESTION 21-100-74

Release No. 1 Quantity Inspected 1 (1st article) Released None

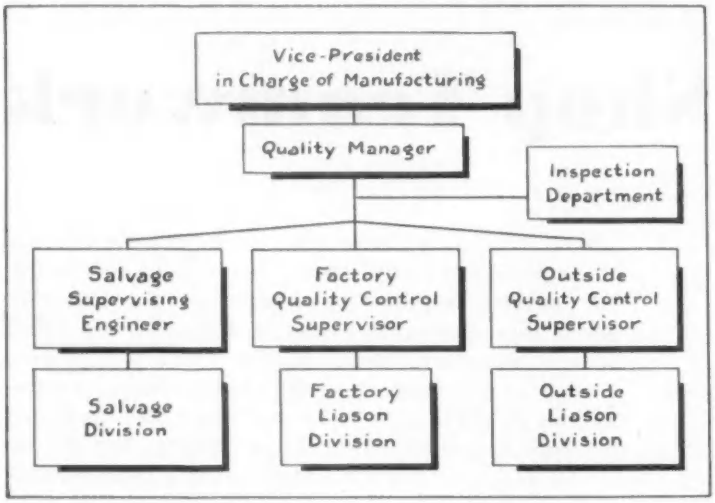
Quantity Sent Through Salvage 1 On Rejection Report No. 6749

THE FOLLOWING ACTION HAS BEEN TAKEN

Tooling Corrected

Date 8/2/43 Signed

Dept. Tooling



Organization chart of the Quality Control Department of the Ryan Aeronautical Co.

Therefore, it is possible to determine at a glance the percentage of units reworked or scrapped to the number of units accepted on any particular order against which statistics are compiled. This is considered an important phase of quality control, in that it gives the Quality Manager a warning when trouble or mistakes creep into the production line which have not been reported otherwise. Investigations are conducted on all unsatisfactory conditions which appear on the graphs, and recommendations for corrections are made to the proper authorities for improvements where necessary.

The Quality Control Department maintains an Outside-Quality Control Supervisor and a staff of liaison men who handle outside quality problems. These men are constantly in contact with vendors. They acquaint themselves with the vendor's problems, and make recommendations where necessary to maintain the highest degree of efficiency and the highest percentage of acceptable work.

Qualifications of all sub-contractors and outside sources of supply are determined through close observance of the Outside-Quality Control Supervisor and his liaison staff. Unsatisfactory conditions are reported immediately to the quality control office, where steps are taken to correct the conditions reported without delay.

The quality control office is informed through Inspection Discrepancy Reports, prepared by the Receiving-Inspection Department, if and when materials or parts received from outside sources do not conform to Ryan standards of quality and workmanship. When such a report is received, the Quality Manager informs the Outside-Production Department and the Outside-Quality Control Supervisor of the discrepancy, and these men immediately take the necessary steps to eliminate the unsatisfactory condition.

The Quality Control Department is responsible to the Army and Navy, and other customers, for every item of work produced for them by the Ryan Aeronautical Co. If differences of opinion arise between members of the Ryan personnel and those of customer's inspection personnel, the details are reported through the inspection office to the Quality Manager, whose responsibility it is to arrive at a satisfactory understanding with the customer.

The Discrepancy Report

The discrepancy-report system comprises three sets of forms (see illustration) and an inter-office memorandum. The first of these forms, The Inspection Discrepancy Report, is used whenever a mistake is uncovered by the inspector, who then prepares the report in detail. These forms are numbered serially. On the upper portion of the form are shown the assembly number, the name of the assembly, the part numbers in question, the release number, quantity inspected, quantity released without regular salvage action, the quantity sent through salvage, and on what Rejection-Report number. In the center portion of the form the inspector outlines in detail the discrepancy being reported. Below this is outlined the action taken by the Inspection Department. In the lower left-hand corner are shown the department believed to be responsible and the date of the report. In the lower right-hand corner appears the signature of the company inspector as well as the signature of the customer's inspector. Below this a space is provided for "date corrected," which is filled in by the Quality Control Department at a later date. When the discrepancy is of a minor nature and does not require a salvage engineer's decision, or when the condition can be corrected in accordance with standard and accepted repair information, the action taken and agreed to by both company and customer's inspectors constitutes a simple salvage disposition, and the part is released to production without going through the regular salvage channel. By this method parts sometimes are corrected and put back in production within a few minutes, whereas, if they were sent through the regular salvage channel, it would require several hours, or even days.

The Inspection Discrepancy Report is prepared in quadruplicate. The white original is mailed to the inspection office and the green copy is picked up by the customer's inspector who signs the report; the yellow copy is filed by the inspector who prepares the report, and the blue copy is rushed to the quality control office. This blue copy is turned over to the factory Quality Control Supervisor, whose liaison staff thoroughly investigates the condition reported. The liaison man makes his report directly on the back of this blue copy and rushes it back to the Quality Control Supervisor, who checks the liaison report and immediately passes the copy on to the Quality Manager.

The nature of the discrepancy being outlined in the report, and the condition which caused it set forth in the liaison report on the back of the blue copy, corrective measures can be taken immediately to prevent further rejections. To this end, a second form, the Quality-Control Discrepancy Report, is prepared by the Quality Control Department. The serial number

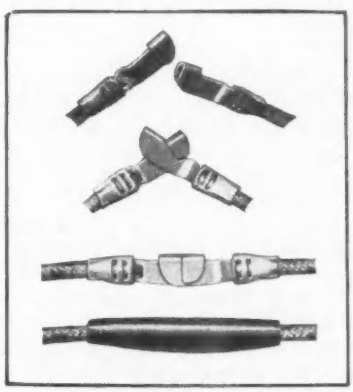
(*Turn to page* 62, *please*)

New Products for Aircraft

Splicing Terminal

Aircraft-Marine Products, Inc., has developed a new solderless splicing terminal with insulation support which affords a quick positive splice for connecting wires until intentional quick disconnection is desired. Precision installation tools make all three crimps in one operation. Only two identical parts are required to make a connection.

The tensile strength of the splice is greater than that of the wire itself, yet the assembly is easily and quickly



AMP Splicing Terminal

uncoupled when desired. A four-point "knife-switch" wiping action assures minimum contact drop through the coupling, and is said to give a perfect electrical connection even under adverse conditions. The contour of the assembly is such that insulation sleeving slips on easily and is then held firmly in place.

Heater for Aircraft

An aircraft heater, known as the Surface Combustion "Janitrol," has just been introduced by Surface Combustion, Toledo, Ohio. This unit uses liquid fuel, generally high octane gasoline, but is said to operate equally well, with minor modifications, on lower octane gasolines and other liquid fuels. Its major purposes are to de-fog, de-ice and anti-ice windshields, gunners' side windows and turrets, to prevent ice from forming on wings and empennage surfaces, to keep bombsights clear, to keep instruments, gun breeches and other equipment operative, and to furnish warmth for the crew.

The heater operates on the principle of burning a vaporized or atomized fuel in the center of a column of spinning air. The whirling action of the combustion air is produced by introducing the air into the cylindrical combustion tube tangentially to its inner surface.

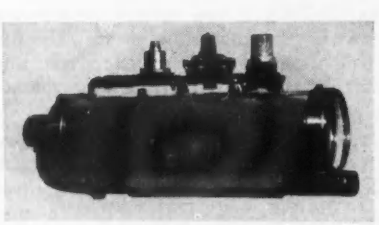
The liquid fuel enters the combustion tube through a vaporizer or spray nozzle ahead of the combustion air inlet. This vaporized or atomized fuel is mixed with the spinning column of air, forming a long, tapering core of enriched gases, completely surrounded by the whirling air column. The combustion process is thus prolonged or delayed for maximum efficiency and heat liberation throughout the full length of the combustion tube. Since the fuel and air are mixed within the heater, its operation is independent of additional mechanical devices, a feature which the manufacturer stresses as being of particular importance.

Plywood Flooring Material

A lightweight flooring material for airplanes has been developed by Technical Ply-Woods, Chicago, Ill. The new flooring, called Hollo-Tech, consists of a top surface of Ply-Tech, a core of spruce wood made up of narrow grid strips, and a bottom surface of Ply-Tech. Either or both surfaces may be faced with vulcanized fibre for greater dielectric value and increased resistance to wear. The top and bottom surfaces are fastened to the core with plastic glue.

The floor is less than ¾ in. thick, weighs approximately 0.85 lb. per square foot, and will support a load of 800 lbs. per square foot on 18 in. spans. The top surface will support a 1 in. by 1 in. block loaded to 500 lbs. and placed in the center area of a cubicle where it is not supported by any grids.

Where bolt holes occur, a block of wood is placed between the top and bottom surfaces before pressing to provide a solid construction where necessary.



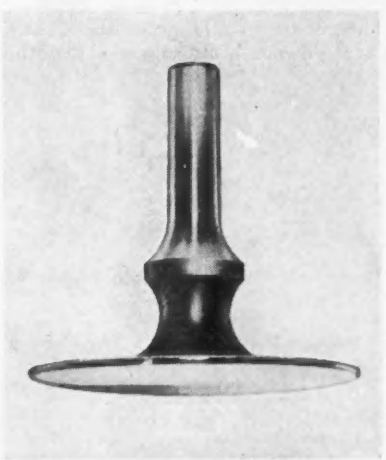
Surface Combustion "Janitrol" aircraft heater

There are other types of Hollo-Tech floors in addition to the one described above. Each is designed for a particular purpose, and may be thicker or thinner, depending on the requirements. Floor panels up to 25 ft. by 4 ft. are being made.

Oversize Rivet Set

An oversize rivet set 2½ in. in diameter that is said to eliminate the danger of dinging thin skins is being produced by the Aero Tool Company, Burbank, Cal. The extra large face and light weight of this set reduce rejects and speed flush riveting operations.

Forged from tool steel and heat-



Oversize rivet set made by Aero Tool Company

treated, the even grain flow of this set is said to have great impact resistance and a minimum fracture possibility. A mirror-like finish on the crown surfaces protects thin skins from dents and abrasions while riveting.

Center Pull Loop Fittings

Center Pull Loop Fittings, another development in the application of Tru-Loc Fittings, to replace spliced loops in the production of preformed aircraft cable assemblies for non-flying controls, were recently announced by the Automotive & Aircraft Division of American Chain & Cable Company, Inc., Detroit, Mich.

They assure precision dimensions, uniform quality, strength and appear-

(*Turn to page* 88, *please*)

New Production

A SELF-ENERGIZED tachometer that can be used either as a "hand type" or "separable type" is being offered by the Ideal Commutator Dresser Company, Sycamore, Ill.

Essentially the Ideal Tachometer consists of a small generator, coupled electrically to an electric meter. The generator consists of a small, permanent Alnico magnet rotor which is mounted on precision sealed ball bearings and capable of continuous operation at any speed within limit of the meter.

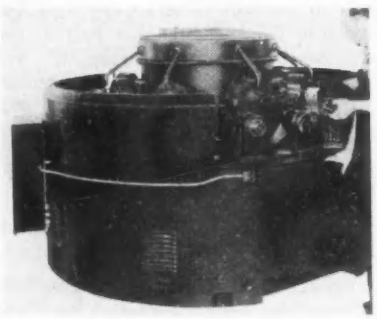
The meter or indicating instrument is a rectifier type, including a D'Arsonval movement. It is capable of withstanding a momentary overload up to four times the maximum speed indication without damage. The meter is provided with two scales—"Hi" and "Lo." The "Hi" scale indicates the maximum reading obtainable. A small switch incorporated in the meter case provides for changing from "Hi" to "Lo" range.

The generator and meter are made as separate elements and coupled together

Ideal electric tachometer

by a precision-made bayonet lock. The units may be used together as a hand type tachometer, or for many applications, including permanent mounting, the generator and meter may be separated and connected by a two conductor electric cord. A 5-ft cord complete with coupling plug is provided, but a cord up to several hundred feet long (of proper size wire) can be used without introducing an appreciable error in scale reading.

A SPECIAL machine has been designed and built by Snyder Engineering Company, Detroit, Mich., to perform a single operation in multiples of eight or a succession of operations in multiples of four on various types of parts such as hubs, flanges, pistons, etc., made from steel, cast iron, aluminum, magnesium, etc. It is readily adaptable to a wide variety of such applications.



Snyder 8-spindle rotary turning machine

The machine consists essentially of eight work spindles and their drive mechanism, and tool slide supports mounted upon a large circular turntable. Each of the eight spindles is an individual turning and facing machine with its own set of tool blocks.

The operation of the machine is as follows: The large turntable revolves slowly, bringing each of the eight spindles in turn to the loading station. While the spindle passes the loading station, it does not rotate and tools are retracted to permit unloading and reloading in safety.

At a point safely beyond the loading position, the loaded spindle starts to revolve and tools advance and feed into the work. Each of the spindles does a complete operation upon an individual workpiece while the workpiece rotates, and while the turntable carries the operating assembly around the circle and back toward the unloading and reloading position.

Ordinarily, each station is equipped with identical tooling to perform an identical operation simultaneously upon eight workpieces. However, the machine can also be arranged to perform successive operations, by setting up four spindles to perform one operation and the next four spindles to perform another operation.

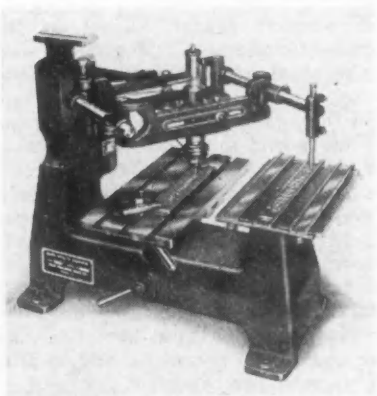
The nature of the work and the length of the cuts determine the time factor in the work cycle, which, in turn, determines the production rate of the machine. Production naturally reaches its maximum when an identical operation is being performed by all eight work spindles.

Provision is made for changing the speed at which the large turntable revolves and the speed at which the individual spindles run, by changing pick-off gears.

H. P. PREIS ENGRAVING MACHINE COMPANY, Newark, N. J., now offers a pantographic engraver for heavier and more varied engraving work than that performed by its standard Model UE machines. This equipment is said to be suitable for engraving on all metals and plastics, for electrical marking on steel and other ferrous metals, and for acid etching on metals or glass.

Designated as the UE-3 Panto Engraver, the machine can be equipped with a forming guide attachment to engrave on concave, convex, spherical, and beveled surfaces. A depth-of-cut regulator is available, to engrave on uneven or curved surfaces. Pantograph ratios range from 1.7 : 1 to 7 : 1, with all main ratios marked on the bars and any intermediate ratio easily obtainable from a pantagraph chart furnished.

The cutter spindle is of a collet-clamping design and can be used with straight-shank cutters or the standard GA tapered-shank cutters. The machine has four spindle speeds, ranging



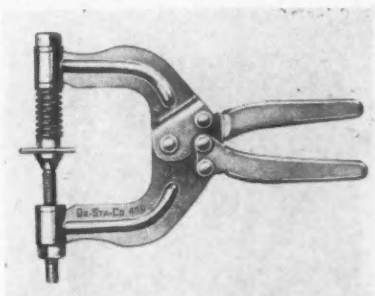
Preis UE-3 Panto Engraver

Equipment

from 5000 to 12,000 r.p.m., making it adaptable for all types of engraving.

The motor is mounted on the base in back of the panto-graph carrier and remains in stationary position. The cutter is fed to the work with a cam-actuated drop lever, the feed-screw collar being graduated in 1/1000 in. The total vertical feed is 5/16 in. Maximum distance from the cutter point to the work table is 3 in. Standard 6 by 12-in. work table, with three T-slots, is adjustable, both horizontally and vertically.

THE Detroit Stamping Company, Detroit, Mich., has just brought out a new portable toggle clamp. This clamp, known as De-Sta-Co Clamp No. 470, with Pressure-Matic feature, is recommended by the manufacturer for use on sheet metal and other work where the individual parts to be clamped vary in thicknesss, up to as much as ⅜ in. on various locations of the same fixture group. The spring fitted on to one of the adjustment spindles provides for this ⅜ in. variation in clamping thicknesses without need for readjustment of spindle.

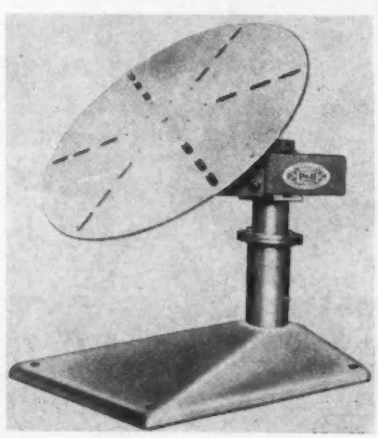


No. 470 De-Sta-Co. toggle clamp

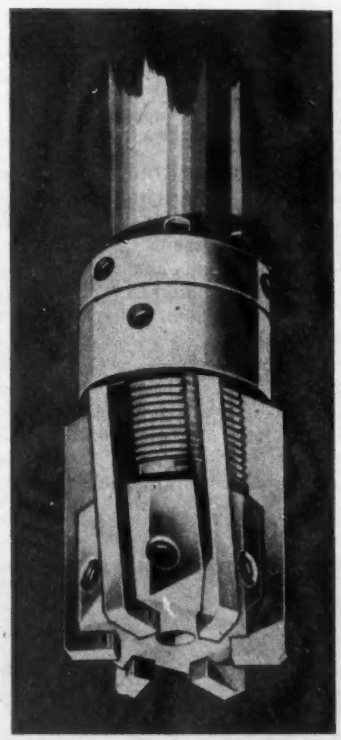
The 3-in. wide throat of this new clamp provides capacity to handle a greater than average range of work. The improved swivel foot permits clamping angles and other odd shapes securely. May be used for clamping metal, wood or plastic parts, for riveting, welding, gluing or other production operations.

This portable clamp has a thumb screw adjustment by which the gap may be set for thickness of work to be clamped. Holding spindles and nuts are copper plated to prevent damage from welding spatter. When closed the clamp automatically locks into position until manually released, holds firmly and releases instantly.

IN the line of welding positioners recently introduced by Harnischfeger Corporation, Milwaukee, Wis., is this 2500-lb capacity model WP-2 which according to the manufacturer is priced in the lowest brackets for its class. It is designed for production line welding as well as job work, maintenance, etc. As in senior models, construction throughout is all-welded rolled steel. Table is 42-in. diameter, has 18 radial slots for mounting fixtures, and is turned manually to suit welding speed. Tilting is controlled by hydraulic power with 135 deg beyond horizontal position attainable. Both table movements have positive locking devices. Telescopic column with self-locating stops provides for table elevation from 28-in. minimum to 60-in. maximum from floor, depending on type of mounting. Portable or column-in-floor mountings are available. The removable table is held to the platen by 10 heavy bolts. Platen index is welded integrally with king pin which is held in position by large safety lock nut. No gearing is exposed. Available extra equipment includes electric power or ring gear and handwheel assembly for table turning with foot or push-button control, higher than standard columns in increments of one foot and roller equipped outboard supports for handling long or large weldments. Equipment for power table rotation at a constant speed of 1 rpm may also be had, and all table assemblies are readily interchangeable in the field.



P & H 2500-lb. welding positioner



Wetmore adjustable inserted blade reamer

A NEW line of reamers, comprising left and right-hand cutting angles, with high speed steel, cast alloy or tungsten carbide tipped inserted blades, is announced by Wetmore Reamer Company, Milwaukee, Wis.

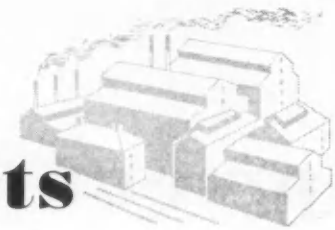
The adjustable, inserted blade design makes it possible to maintain new tool efficiency with consequent saving in tool cost. Type 36 is available in sizes and styles for holes ⅝ in. to 31/32 in. Type 11 takes care of sizes and styles from 1 in. to 3 in. (Types 36 and 11 are available in either straight or taper shank). Type 7 shell reamers take care of all hole sizes from 1¼ in. to 6 in. inclusive.

VARD, INC., Pasadena, Cal., has brought out a line of snap gages with John-Sons rolls. This particular type of roll thread snap gage will check both right and left-hand threads.

The improved Vard snap gage frame which has been used to hold these new John-Sons rolls has a special grip molded to hand contours and wide machined pads for bench stand set-ups, and is made of a special grade high strength cast iron with low reaction to temperature changes. It is protected by durable "Wrinkle Finish."

(*Turn to page 78, please*)

New Products



Spotlight for Arc Welding Operators

A spotlight designed to provide glareless illumination of sufficient intensity for an arc welding operator to see his work distinctly through the dark lens of a welding helmet prior to striking the arc has been announced by the Electric Welding Division of the General Electric Company, Schenectady, N. Y. The new spotlight (Cat. 89x391) is said to be especially desirable for production-line welding in which the establishment of the arc must be made quickly and accurately, such as in the welding of thin materials, light alloy castings, and aircraft parts.

G. E. Spotlight

The spotlight is designed to increase production by saving time and reducing operator fatigue, since it is not necessary for the operator to lift his helmet before striking the arc. It also reduces spoilage of exacting work because the operator can strike the arc precisely where required.

Mounted on an upright, telescoping metal standard and set in an 18½-in. diameter, 30-pound cast iron base, the spotlight consists of three 300-watt reflector spot lamps, surrounded by a circular shade. Rated to give 1000 hours of continuous operation at 120 volts, the lamps are mounted in adjustable porcelain holders, so that the area covered by the light beam can be increased from a single, sharp spot 7 in. in diameter to a clover leaf shaped pattern approximately 17 in. across at its widest point.

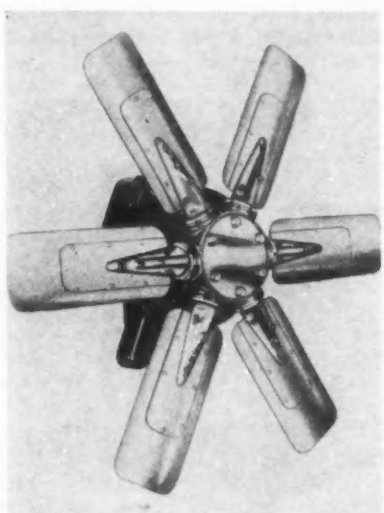
The light can be raised or lowered on its standard, and held in place by a locking thumb screw, to any point from 45 to 76 in. above the base. A universal, friction ball-joint between the shade and the upright standard permits the light beam to be directed and held at any angle downward between vertical and 30 deg. below horizontal.

Controlled by a foot-operated switch which is depressed by the operator while the arc is struck, the unit is equipped with a 10-ft. oilproof, heavily jacketed cable, with plug for connecting the light to the electric circuit. Except for the inside telescoping section of the standard, the entire unit has an attractive black crackle finish, and is furnished completely wired and ready for operation.

Improved Kontrol-Fan

An improved controllable-pitch blade fan kit has just been introduced by Kontrol Fan, Inc., Los Angeles, Cal. The major change in the design of the latest model is that the controlling thermal element is direct-connected through the fan spindle to the blade-turning mechanism. Earlier Kontrol-Fans used separately attached thermal units, and the fan blades were rotated or feathered by means of outside linkage.

None of the basic principles of operation has been altered, however. The entirely automatic variable-pitch fan continues to be actuated by a thermostatic element directly controlled by the temperature of by-passed engine jacket water. As engine temperature goes up, fan blade pitch increases at the same time, providing greater cooling. When the engine is cold, fan blades remain at zero or low pitch until correct operating temperature is reached. No water jacket obstructions restrict the free circulation of the coolant used. Fan blades feather from practically zero to as much as 38 degrees pitch. The fan units may be used for gasoline, natural gas and Diesel engines; may be installed in heavy, powered industrial equipment and are applicable to many other cooling jobs where automatic thermostatic control is required.



Latest type Kontrol-Fan

Combustion Tube Laboratory Furnace

The Lindberg Engineering Company, Chicago, Ill., is offering a combustion tube laboratory furnace for carbon and sulphur determinations as well as gravimetric determination of carbon and all alloy steels, including stainless and heat-resisting steels. Temperatures obtainable for continuous operation are up to 2500 deg F, while for occasional operations temperatures up to 2650 deg F are permissible. High-temperature Globar elements are installed or removed without total dismantling and assembling of unit.

Lindberg combustion tube furnace for laboratory use

All necessary controls are located on the face of the furnace. Temperature

(*Turn to page 72, please*)

Instrument of the ~~Immortals~~!

Hurtling through blackness somewhere on the other side of the world, a bomber streaks home from its battered, burning target . . .

Not so many nights ago, its pilot sat in the living room of his home and listened to the world's finest music. Tonight, his living room is a compartment . . . and the music he listens and prays for, is the unbroken rhythm of his engines. Among the many instruments he depends upon is the one you see pictured here, for it tested the magnetos of his plane's engines before he left on his mission . . . tested them for their ability to function perfectly through heat, cold, humidity, changing altitudes and speeds.

Living rooms have changed for thousands of young Americans. Instruments like this Denison HydrOILic Test Stand are all-important in their lives today. Someday those men will return to quiet homes and travel tranquil airways . . . then HydrOILics will serve them in Peace! The Denison Engineering Company, 1178 Dublin Road, Columbus, Ohio.

Your Problems for Tomorrow...

You may find oil-hydraulics the answer to problems involving design, production or improvement of your products. Denison HydrOILic engineers have successfully adapted the smooth accuracy, flexibility and controllability of oil-hydraulic power to a remarkable variety of equipment. We'll be glad to discuss your problems with you.

INDUSTRY'S NEW RIGHT HAND FOR AVIATION

DENISON EQUIPMENT *in* APPLIED HydrOILics

Landing Craft Program Calls On Auto Industry's Resources

"Ducks," "Water Buffaloes," Trucks, Arms and Aircraft to Boost Output This Year

Stepping up of the Navy's landing craft program to top priority, even ahead of airplanes and aviation gasoline, will find the automotive industry called upon for greater production of marine engines, amphibian trucks and tractors. The program calls for 80,000 invasion craft, of which 25,000 have been built, and will cost about $5,300,000,000. Approximately 4000 prime contractors are involved. Detroit Diesel Engine Division of Gm, one of the largest manufacturers of power plants for invasion craft, builds the Quad, a combination of four of the Series 71 6-cylinder Diesel engines developing upwards of 750-hp. and used to power a number of invasion craft, including LC-I (landing craft, infantry), LC-T (landing craft, tanks) and other types of shallow draft vessels.

Schedules at the Detroit Diesel Division have been so increased that it has become necessary to transfer the manufacture of fuel injectors to the Grand Rapids plant now operated by Saginaw Steering Gear Div. of GM. The Grand Rapids plant will continue to make Army carbines until the present program is completed, as well as assuming the production of the injectors. Need for additional floor space and manpower to meet the expanded Navy program prompted the move to Grand Rapids, and will be known as the Diesel Equipment Div. of GM and will manufacture injectors for the Cleveland Diesel Engine and Electro-Motive Divisions as well as for Detroit Diesel. Hudson and Chrysler also are important producers of marine engines for landing barges.

General Motors Truck & Coach Division of GM has attained capacity output of 2½-ton 6x6 amphibious trucks, the "ducks," which played such an important part in the invasion of Sicily and Italy. The new program calls for such a number of these vehicles that the Chevrolet Motor Division plant of GM at St. Louis also has undertaken their manufacture. Chevrolet has been supplying all the sheet metal, a majority of the axles and transfer cases and a substantial number of engines for the 2½-ton 6x6 military truck made by GM Truck & Coach, as well as assembling an important number of these vehicles. Participation of Chevrolet in this 2½-ton military truck program for the past two years has permitted a rapid conversion to the amphibious version of the same vehicle. Chevrolet will continue to assemble the same number of 2½-ton trucks, superimposing the "duck" program on this production.

Graham-Paige Motor Corp. is accelerating the production of 11-ton amphibian tractors, a second and larger version of this type vehicle called the "water buffalo." A previous type, the "alligator," was pioneered by Food Machinery Corp. Ingersoll Steel & Disc Division of Borg-Warner Corp. also is making amphibian tractors at Kalamazoo, Mich.

Despite the fact that more than one and one-half million trucks have been produced in the U. S. since the defense program was inaugurated in May, 1940, the 1944 military truck schedules call for even larger output than in 1943.

(*Turn to page 58, please*)

Civilian Truck Quotas

Revised production quotas for the manufacture of 123,429 trucks for civilian use in 1944 as approved by WPB follow: Chevrolet, 33,122; Ford, 28,149; International Harvester, 19,683; Dodge, 10,367; GM Truck, 9851; Mack, 4504; White, 4442; Diamond T, 2887; Autocar, 2727; Federal, 2034; Reo, 1594; Brockway, 1237; Euclid, 522; Sterling, 510; Peterbilt, 317; Kenworth, 291; FWD, 297; Corbitt, 200; Walter, 188; Dart, 179; Oshkosh, 152; Koehring, 59; Linn, 20; Duplex, 10; Doane, one; unassigned, 148.

Not the American Way of Life

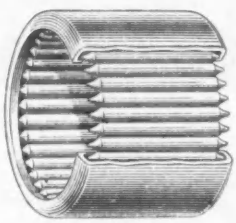
"The Nazi world of ideas will become the common property of all peoples, even our enemies, through this struggle. One state after another will be increasingly compelled to resort to the National Socialist thesis . . ."

Adolf Hitler

"Although National Socialism has posed as the protector of the German business community and the interests of investors, it has progressively narrowed the area in which business can make its own decisions. Without assuming the burden of actual ownership and operation, the government has so curbed and directed the conduct of business that the men in charge of private enterprise are deprived of all real freedom of action."

The Brookings Institution

Yes, these are ALL Needle Bearings . . .



TYPE DC

TYPE NCS

DESIGNED FOR TODAY'S NEEDS AND TOMORROW'S TRENDS—THEY OFFER A UNIQUE COMBINATION OF ADVANTAGES

You may not have realized how many *different* types of Needle Bearings have been developed since the first Torrington Needle Bearing was introduced.

Some of them are illustrated here.

Common Advantages

All of them employ the basic principle of a full complement of small diameter needle rollers within a single, compact retaining raceway. And all of them offer the characteristic advantages of the original Torrington Needle Bearing:

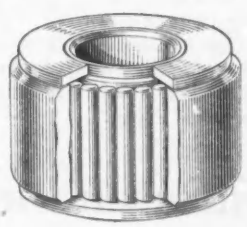
1. Small size, light weight and compact design
2. High radial load capacity and elimination of stress concentration
3. Unit construction which facilitates handling and installation
4. Efficient lubrication; freedom from maintenance attention
5. Low cost

For Special Requirements

Each of the "newer" types is designed for a particular task . . . a particular set of conditions.

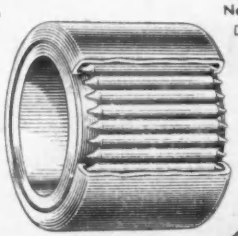
Some of them were so well established even before the war as to be almost universally used for certain applications. For example, the NCS Type Needle Bearing, of rugged construction, designed for heavy service, and available in standard sizes to fit an inner race of from $\frac{5}{8}$" O.D. to $5\frac{1}{2}$" O.D., is widely employed in equipment for the oil industry where service conditions are severe and rough "handling" the rule.

Others are the result of wartime demands for greater efficiency in speeding production lines and stepping up performance records. The AT Type Needle Bearing, for instance, has a heavy, through hardened outer race designed to give maximum capacity obtainable from the rollers



TYPE AT

used. It has found wide application in the aircraft construction where it is used with standard AN bolts and is designed to have a static non-Brinell capacity equal to the single shear strength of the bolt. Standard sizes in the AT Type range from 0.1900 to 1.0000" to fit on bolts No. 3 to 16.



DC (INNER RACE)

For Postwar Designs

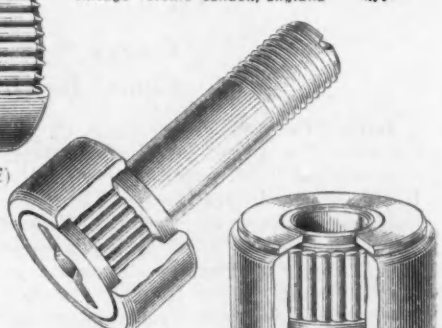
Where the efficiency of anti-friction operation is desired, and space, weight and cost are vitally important considerations—as they will be in designing to meet postwar trends—Needle Bearings provide the answer!

With the development of a complete line of all types, The Torrington Company offers the product designer and engineer a selection to meet virtually *any radial load requirement*. The experience of Torrington engineers is available to aid in design and application of Needle Bearings to *your* particular job. A copy of our current Catalog No. 116 will give you an outline of the types, sizes and capacities currently available for essential needs. And if our engineering staff can assist in selecting the right type for a particular job, write, outlining your need.

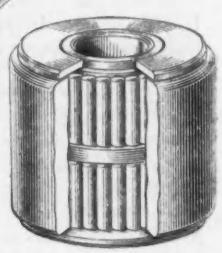
THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend 21, Ind.
"Makers of Needle Bearings and Needle Bearing Rollers"

New York Boston Philadelphia
Detroit Cleveland Seattle
San Francisco Los Angeles
Chicago Toronto London, England



TYPE RC



TYPE FDT

TORRINGTON
NEEDLE BEARINGS

An M-4 high speed medium tractor can transport 11 cannoneers and a driver, has space for the ammunition for a 155 mm. gun, and can easily tow the "Long Tom" besides. Ten of the machines are the new babies of the Field Artillery Replacement Training Center of Fort Sill, Okla., and soldiers are finding the vehicles easier to drive and more maneuverable than a large Army truck.

Nickel Output Near 1942 All-Time High

"Production of nickel in 1943 will approximate the all-time high of the previous year, despite an acute shortage of labor and the resultant inability of the industry to use to the fullest extent its greatly expanded production facilities," said Robert C. Stanley, Chairman and President of The International Nickel Company of Canada, Limited.

"The output of nickel in the Sudbury district of Canada, where the most important known nickel deposits are located, has in recent months dropped 10% below peak production," Mr. Stanley continued. "The decline was due to the effects of the shortage of labor as well as the consequences of having to use many new inexperienced workers.

"The demands of the United Nations' war program for nickel have been met. Control of distribution by governmental authorities in Ottawa, Washington and London mastered what appeared to be a critical situation in the supply of nickel. These authorities also made use of scrap material which had accumulated within industries that were producing war equipment in order to supplement the supply of primary metal. It is understood that in the current ingot production of alloy steel within the United States, the United Kingdom and Canada about half of the required nickel is obtained from revert and purchased scrap."

Union Membership Maintenance To Be Opposed in New Contracts

Briggs Mfg. Co. Joins GM in Asking That Clause Be Dropped, After Picketing Trouble

Joining General Motors Corp. in asking that the maintenance of membership clause in its contract with the UAW-CIO be dropped in pending negotiations for contract renewal, Briggs Mfg. Co. has announced it will oppose any attempts to continue the clause in effect. Briggs' action followed the setting up of union picket lines at several of the company's Detroit plants in an attempt to enforce dues collections from union members. Emil Mazey, president of Local 212 of the UAW-CIO, was arrested by police as the outgrowth of an altercation involving four non-union women workers. They charged that he attempted to keep them from entering the plant. Briggs' officials contended that 1000 out of 6600 employes at the company's Mack Ave. plant were kept from work by the union's dues picket line, while absenteeism tripled at the company's Hamtramck plant as a result of similar union tactics.

W. Dean Robinson, Briggs vice-president, informed Mazey that the maintenance of membership clause, voluntarily granted by the company Nov. 13, 1942, would not be voluntarily renewed. In a letter to Mazey, he wrote:

"Local No. 212, under your leadership, has seen fit to ignore the privilege granted to your organization under the maintenance of membership clause, which provides that if union members who were in good standing at the beginning of the contract or who have joined since the contract was signed, do not pay their dues, the union can advise the company and the company will dismiss them. Instead, officials of your local have attempted by force and coercion to collect due from members of your organization without advising the company who the delinquent members are, and notwithstanding the fact that the union has agreed in its contract with the company not to use coercion or intimidation on employes for any reason. Officials of your local also have used the dues drive intimidation technique to try to coerce and force non-union employes of Briggs into joining the union. . . . We have many women in our employ who did not work before the war and who are not and have not been members of your union. They are working because they feel it is their patriotic duty to do so."

Although maintenance of membership clauses have been imposed by the WLB in most contract negotiations since the war, there was one notable exception last Aug. 19 when the National WLB denied such a clause to the UAW-CIO with Chrysler Corp. The board cited the numerous work stoppages that had occurred in Chrysler plants and the irresponsibility of local union leadership. The union can ask for reinstatement of the clause after Feb. 19 but the frequent strikes that have taken place in some Chrysler plants since last August make it questionable whether WLB would grant it. One large company having a maintenance of membership clause in its contract has dismissed somewhat less than 200 employes for failure to keep up their union dues.

Under standard WLB procedure, a union member found, after checking, to be delinquent in his dues is given a hearing before a joint committee of

(*Turn to page 90, please*)

CALENDAR

Convntions and Meetings

SAE Annual Mtg. & Eng. Display, Detroit ..... Jan. 10-14
Institute of the Aeronautical Sciences—Annual Meeting—New York City, ... Jan. 25-27
American Society of Heating and Ventilating Engineers — 50th Anniversary Meeting—New York City, ... Jan. 31-Feb. 2
American Society for Testing Materials Spring Meeting, Cincinnati, ... Feb. 28-March 3
American Society for Testing Materials (47th Annual Meeting), New York City ..... June 26-30

413,349 Stockholders Own General Motors

The total number of General Motors common and preferred stockholders for the fourth quarter of 1943 was 421,945 compared with 414,380 for the third quarter of 1943 and with 413,349 for the fourth quarter of 1942. The 1943 fourth quarter increase is due primarily to the issuance of common stock in connection with the acquisition by General Motors of the assets of the Yellow Truck & Coach Manufacturing Company.

There were 400,400 holders of common stock and the balance of 21,545 represents holders of preferred stock. These figures compare with 392,840 common stockholders and 21,540 preferred for the third quarter of 1943.

2 HIGHER PRODUCTION RATES

In the postwar period the manufacturer will face two demands that are difficult to reconcile: (1) his customers will want products of highest possible quality at lowest possible cost, and (2) labor will exert every effort to maintain highest hourly wage rates. Without higher machine production rates, such demands are obviously impossible. Inevitably the manufacturer must have machines which will produce more and better products with fewer man hours and machine hours per unit.

Vickers Hydromotive Controls are solving this problem for machinery builders in many industries. For example, completely automatic operating cycles are easily obtainable with Vickers Hydraulic Equipment... much of the required skill can be built into the machine. Flexibility in hydraulic control systems frequently permits time saving by traverse and return at higher speeds. Overload protection can be positive and automatic. Controls are simple and easily operated; they can be so interlocked that neither the work nor the machine can be damaged by the inexperienced or careless operator.

Vickers Application Engineers will be glad to discuss with you the higher production rates and the many other advantages of Vickers Hydromotive Controls.

VICKERS
Incorporated
1428 OAKMAN BLVD.
DETROIT 32, MICHIGAN

Application Engineering Offices:
CHICAGO • CLEVELAND • DETROIT • LOS ANGELES
NEWARK • PHILADELPHIA • ROCKFORD
TULSA • WORCESTER

What will Users Want in POSTWAR MACHINERY?

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function

Possibility Seen of Change in Requirements of Steel for War

Readjustment of Metal Values to Production Costs Poses Another Problem for Producers

By W. C. HIRSCH

Current developments affect both metal producers and buyers so much more directly than do output records for last year that the latter come in for minor attention. That there was a sharp upturn in production of iron and steel as well as non-ferrous metals has long been known, and what statistical reports are now coming out, merely confirm this. Continuingly perplexing, however, is how much of the increased output will be needed in the immediate future for carrying on the war.

According to WPB Chairman Donald M. Nelson, first quarter 1944 programs will require 95 to 100 per cent of all steel producing capacity. Much, if not most of this is for an expanded landing-craft program, which calls for more than a million tons of sheets alone for landing-mats. Orders for nearly all of this tonnage are reported to have been placed, flat steel rolling mills, for the most part, starting the new year with no blank spaces in their production schedules for weeks to come.

At the same time steel producers as well as consumers are watching closely the efforts of the WPB Redistribution Divisions in the disposal of surplus materials. So far the tonnages offered have been admittedly light, but the very existence and activity of these outlets serve to keep before the industry the possibility of a sudden change in the Government's war requirements. The reluctance of the authorities to the freeing of any part of steel mills' capacity for the making of civilian material, when unforeseeable changes in the war program may suddenly call for their full operation on war requirements, is fully understood, but this

(*Turn to page* 148, *please*)

Cutting Tool Makers Form an Association

Formation of a national association of cutting tool manufacturers was voted practically unanimously December 10 in Detroit by 150 representatives of some 100 manufacturers of cutting tools, who registered as "temporary members" pending the formation of the association proper.

To expedite the formation, the meeting—attended not only by Michigan manufacturers but also by a number of manufacturers from other states—elected a temporary board of nine directors, with W. G. Robbins, Carboloy Company, Inc., Detroit as chairman. Other members of the temporary board are: Oscar L. Bard, president, Michigan Tool Company, Detroit; H. R. Conner, vice-president, Detroit Broach Company, Detroit; George W. Frick, manager, Firthite Tool Division, Firth-Sterling Steel Company, McKeesport, Pa.; E. A. Goddard, vice-president, Goddard and Goddard Company, Detroit; Norman Lawton, partner, Star Cutter Company, Detroit; R. G. Michell, president, Eclipse Counterbore Co., Detroit; R. M. Severance, president, Severance Industries, Inc., Saginaw, Mich. and R. H. Wolfe, president, Arrow Tool and Reamer Company, Detroit.

Decision to form the Association on a National basis was voted as a result of considerations of the many National objectives of such an association and the expressed desire of tool companies outside the State of Michigan to take part in its activities.

PERSONALS

The election of **Palmer Nicholls** as a vice-president of Bendix Aviation Corp. and his appointment as general manager of the newly created Pacific Div. of the corporation, has been announced.

Frederic C. Weyburne has been named general manager of the Marshall-Eclipse Div. of Bendix Aviation Corp. at Troy, New York. He succeeds **Furber Marshall** who resigned to become president of The Pharis Tire & Rubber Co., Newark, O.

Ward M. Canaday, recently elected president, and chairman of the board of Willys-Overland Motors, and **David W. Rodger**, vice-president and secretary of the Federal-Mogul Corp., have been elected members of the board of the Automotive Council for War Production.

The Auto-Diesel Piston Ring Co. has announced the appointment of **August H. Henrich** as assistant to the vice-president and the general manager.

Archie Chandler, vice president of the American Pulley Co. has announced his retirement from active sales management of the company. **Frank E. Brown**, formerly assistant sales manager, has been named to succeed Mr. Chandler as general sales manager.

Donald S. Klippert has been appointed assistant general manager of sales of the Timken Steel and Tube Div., Timken Roller Bearing Co. Mr. Klippert has been Cleveland district manager of the Timken Steel & Tube Div.

Charles M. Burgess, president of Burgess-Norton Co., has been appointed by Governor Dwight Green, of Illinois, as one of the five members of the higher education survey commission created by the state legislature.

Chris F. Tonne has joined the All-Steel Equip Co., Inc., as advertising manager.

Sterling Tool Products Co. has anncouned the appointment of **J. A. Proven** as general sales manager.

Gar Wood Industries, Inc. has announecd the appointment of **Donald J. Luty** as general manager of the Heating Div.

Appointment of **H. W. Lange** as sales manager of the Fire Div. of Cardox Corp. has been announced by the company.

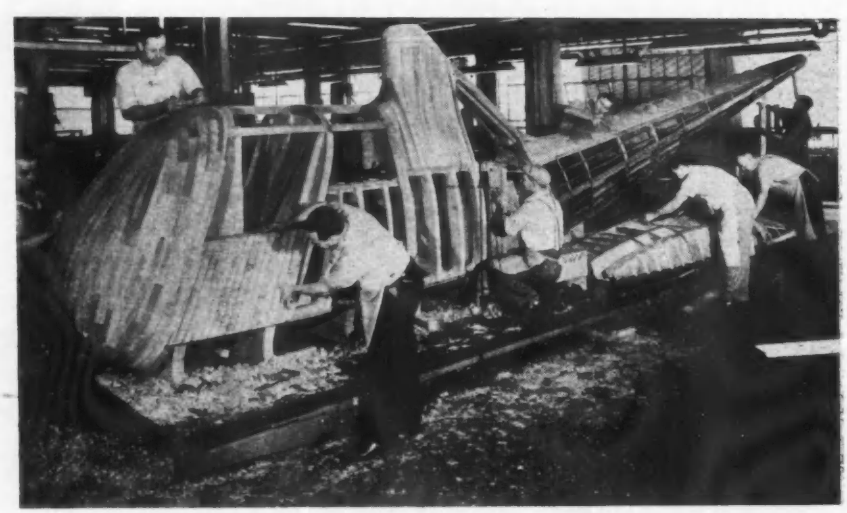
Fruehauf Trailer Co. has announced the appointment of **Ralph G. Caulley** as director of purchases. Mr. Caulley becomes associated with Fruehauf aften ten years with Republic Steel Corp.

M. S. Brooks has been appointed acting sales manager of Studebaker Corp., during the absence of general sales manager **C. S. Fletcher** as director of field development for the Committee for Economic Development. Other appointments by Studebaker have been the designation of **A. J. Chanter** and **Paul R. Davis** as assistant sales managers in addition to their duties as regional managers of the Boston and Atlanta regions, respectively.

The appointment of **Frank Sanderson MacGregor** to be general manager of the Electrochemicals Dept. was announced today by E. I. du Pont de Nemours & Co.

(*Turn to page* 56, *please*)

Species Helicopterus



Like the skeleton of a giant prehistoric monster, this mockup of a military helicopter is taking shape in the engineering laboratories of Nash-Kelvinator Corp. From this wooden dummy will be made the jigs, fixtures and sectional design tools necessary to mass-produce other "live" helicopters which the corporation has a contract to build for the Army Air Forces under an arrangement with its originators, the Sikorsky Aircraft Div. of United Aircraft Corp.

What's Ahead?

No. 1 in a Series

Experts are working experimentally on a universal sign language for use during the period of reconstruction following the war. It has a vocabulary of about two thousand words and can be learned in about a month.

★

Reshingling of homes may be entirely eliminated after the war. With plentiful cheap aluminum as one of the benefits of the great disaster, we expect to have aluminum shingles, and the glass industry has already developed a lifetime glass shingle.

★

Radio waves are now being used to spread the layer of tin on tin cans and thinner than it was before the war.

★

The Diesel engine is close to its long-sought ideal of one pound per horse power. This may indicate that this thrifty engine, already scheduled to power our postwar trucks, may also be suitable for our pleasure cars.

★

Little by little new ideas combine to make flying more practical for tomorrow's civilians. One of these is a simple device for night landing which uses two lamps aimed toward the ground. The beams of these lamps are focused so that they come together to form a single spot of light on the ground when the plane is at exactly the right height for "setting down."

★

A new fuse for artillery shells is said to be so sensitive that it will explode the shell on hitting a raindrop.

★

The use of aluminum can reduce the weight of a freight car from forty-five thousand to fifteen thousand pounds with a corresponding increase in capacity.

★

Factories have been built with heating pipes permanently laid in the solid concrete floor. The method seems to be practical, economical and suitable for the heating of our homes.

★

In spite of the war, the Dutch have been able to produce a new hybrid plant, a cross between the carrot and the beet called the "wobbie".

To supply a Pacific coast shipyard with 152′ one-piece keels for Navy minesweepers, giant trailers are being used that haul 60 tons of Douglas fir logs of this length.

★

Experiments are being made with artificial teeth held in place by magnets.

★

It is expected that vast amounts of magnesium will be used after the war, and it is encouraging to know that our supply is large and beyond the reach of the enemy. Although there is only fourteen one-hundredths of one percent of magnesium in sea water, there are four and one-half million tons in a cubic mile.

★

Fifty thousand patents, formerly the legal property of our enemies, are now available to American industry.

★

The electron microscope will now measure particles as small as one-millionth of an inch.

★

The Civil Aeronautics Administration expects us to have half a million private and commercial airplanes by 1950.

★

A new synthetic textile filament, the finest yet produced by man or nature, is so small that it takes twenty thousand miles of it to weigh a pound.

Automobile tires are now being checked for invisible flaws by passing high-frequency sound waves through them.

★

Plastic bearings for machinery will require no lubricants for moderate speeds and loads, and in many cases water has been found to give sufficient lubrication for even high speeds and heavy loads.

★

"Facsimile", a method of printing a miniature newspaper by radio in individual homes, was tried experimentally before the war began. By this method the printing is done during the night and a newspaper, complete with illustrations and advertising, is ready at breakfast time.

★

There is a very good chance that we may have television in full color and three dimensions. It may also be possible to store up television broadcasts to be re-run later.

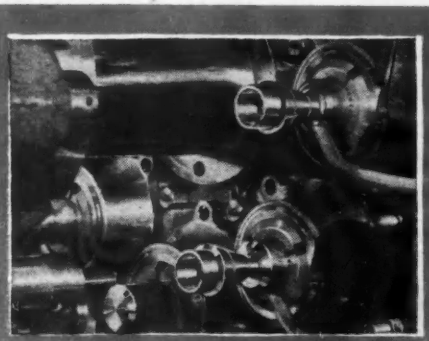
★

A micro-hardness tester is now made that can test a single microscopic grain of metal.

★

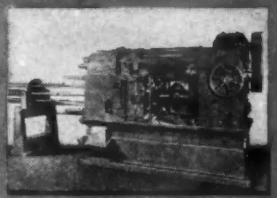
Shipwrecked sailors will soon have the benefit of a tiny searchlight no bigger than a walnut that is visible for 60 to 70 miles and good for 100 hours of use.

★



This big 8 spindle Conomatic completes seventeen operations required in the machining of an artillery shell fuse body *in 18 seconds.*

This is real production—the sort of production needed to win the war. Manufacturers will need this sort of production *after the war* if they are to meet competition, particularly if new ideas and better merchandise are to be put in the hands of all our people.



CONE

AUTOMATIC MACHINE CO., INC.

WINDSOR, VERMONT, U. S. A.

War Engineering—Annual Meeting Of SAE to Open in Detroit, Jan. 10

Sessions Will Cover Aircraft, Cars, Trucks, Buses, Engines, Fuels, Lubricants, Materials

The SAE War Engineering—Annual Meeting of the Society of Automotive Engineers will be held in the Book-Cadillac Hotel, Detroit, Jan. 10 to 14. Following is the tentative program arranged for the five days:

January 10

TRANSPORTATION & MAINTENANCE—"Ordnance Keeps 'em Rolling—What Fleet Men May Learn From Army Tests of Synthetic Tires," Lt. Col. B. J. Lemon and Capt. J. J. Robson, Ordnance Dept., Tank Automotive Center.

PASSENGER CAR — "Air Cooled Engines in Automotive Vehicles," Chester S. Ricker, Detroit Editor, *Wings;* "An Informal Long-Range Forecast of Motor Gasoline Developments," D. P. Barnard and R. F. Marschner, Standard Oil Co. of Indiana.

TRUCK AND BUS — "What Do Fleet Operators Want in Post-War Trucks?" Gavin Laurie, Atlantic Refining Co.

PASSENGER-CAR BODY — "The Practical Post-War Car," E. C. DeSmet, Willys-Overland Motors, Inc.; "Amphibian Truck Developments," Col. E. S. Van Deusen, Ordnance Dept., Tank Automotive Center.

JUNIOR STUDENT — "Design Details of Mosquito Bombers," R. B. McIntyre, De Havilland Aircraft of Canada, Ltd.

January 11

TRANSPORTATION & MAINTENANCE — "Engine Valve Reclamation," Norman Hoertz, Thompson Products, Inc.; "Reconditioning Brake Drums," J. V. Bassett, Raybestos-Manhattan, Inc.

AIRCRAFT ENGINE — "Synthetic Rubber Applications on Aircraft Engines," Gertrude Spremulli, Ranger Aircraft Engines; "Difficulties With Engines Installed in Civil Aircraft," S. H. Rolle, Civil Aeronautics Administration; "Aircraft Engine Inlet and Exhaust Porting," V. C. Young, Wilcox-Rich Div., Eaton Mfg. Co.; "Cooling System Performance of Liquid Cooled Engines," C. A. Stamm and W. E. McCravey, Chrysler Corp.; "A High Altitude Coolant Pump," E. T. Vincent, University of Michigan.

MATERIALS—"Considerations Regarding Postwar Utilization of Aluminum and Magnesium," L. W. Kempf, Aluminum Company of America; "The General-Purpose Synthetic Rubbers in the Automotive Industry," A. A. Somerville, R. T. Vanderbilt Co.; "Wartime Plastics Applications and Their Peacetime Implications," Gordon Brown, Bakelite Corp.

BUSINESS SESSION—Nomination and election of members-at-large of annual nominating committee, announcement of election of officers for 1944, presentation of life membership.

PASSENGER CAR — "Tire and Track Flotation of Military Vehicles," Lt. Col. J. E. Engler, Desert Training Command, Camp Seeley; "On the Strength of Highly Stressed, Dynamically Loaded Bolts and Studs," J. O. Almen, Research Labs. Div., General Motors Corp.

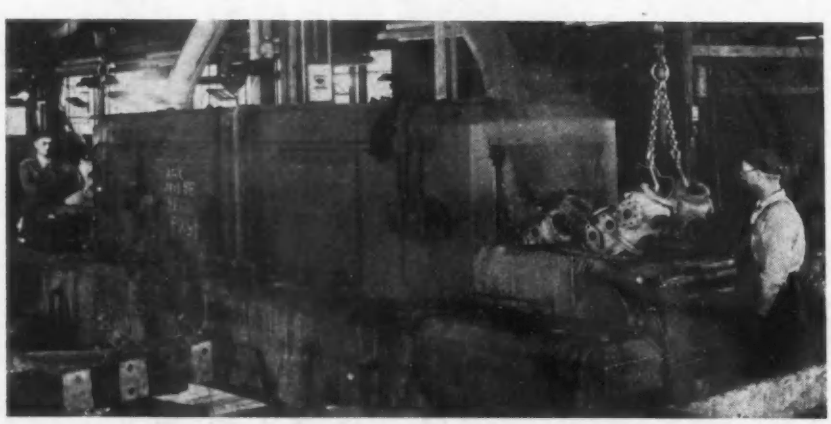
January 12

PASSENGER CAR—"Winterization of Military Combat, Transport and Other Purpose Vehicles," R. L. Weider, White Motor Co.; "Some of the Problems Presented in L-Head Engines Due to Continued Increase in Compression Ratios," E. J. Willis, Aluminum Company of America.

AIRCRAFT ENGINE — "Low-Cost Cylinder Design for Commercial Air-

(*Turn to page* 60, *please*)

Detrex Washing Machine



Here is a new Detrex washing machine installed in a plant of the Minneapolis-Moline Power Implement Company, to clean tractor and winch cases. In the illustration originally used in the article "Diversification of War Products at Minneapolis-Moline Plant," which appeared in the November 1 issue of AUTOMOTIVE and AVIATION INDUSTRIES this washing machine was not properly identified as a Detrex.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

A continuing advance in business activity, carrying the general average to a record level, is indicated by current reports. The seasonally adjusted index of *The New York Times* for the week ended Dec. 4 stands at 148.7, as against 147.2 a week earlier and 133.7 a year ago.

Department store sales, as reported by the Federal Reserve Board, increased during the week ended Dec. 11 from 252 to 272 per cent of the 1935-39 average. They were, however, one per cent below the corresponding 1942 figure. Sales for the four weeks ended Dec. 11 were 9 per cent above the total a year earlier.

Railway freight loadings during the same week totaled 823,211 cars, 4.6 per cent below the figure for the preceding week but 10.6 per cent above that for the comparable period last year.

Electric power production during the same period was larger than in the preceding week and was 16 per cent above the output a year ago. For the week before, an increase of 17.4 per cent over the comparable 1942 figure was reported.

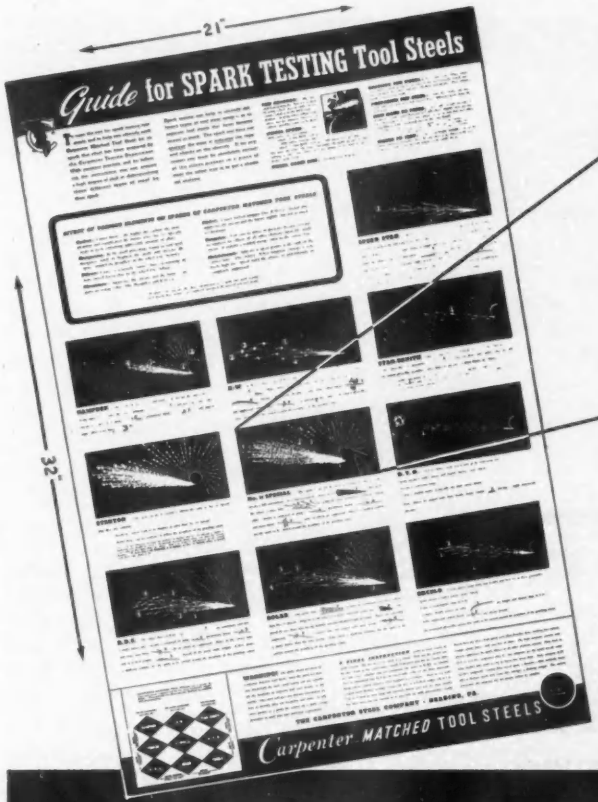
Crude oil production in the week ended Dec. 11, registered the fourth consecutive decline from the peak rate attained in the second week of November. Output averaged 4,376,700 barrels daily, 59,750 barrels below the record figure and 48,400 barrels less than the average recommended by the Petroleum Administration for War.

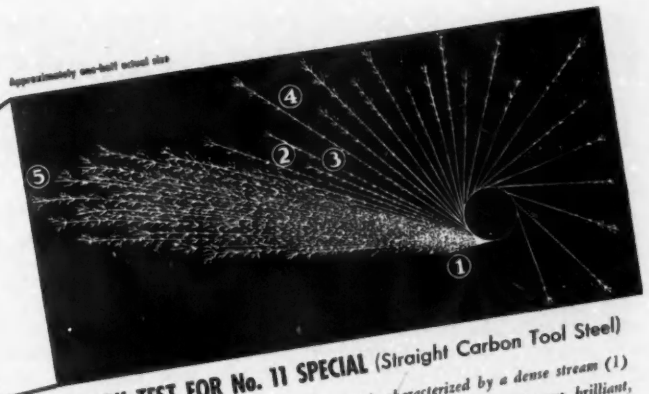
Bituminous coal production during the week ended Dec. 4 totaled 12,650,000 net tons, as against 12,450,000 tons produced in the week before and 11,331,000 tons in the corresponding period last year. Total production this year to date is 0.7 per cent below that for the comparable period last year.

Engineering construction contracts awarded during the week ended Dec. 16 totaled only $26,792,000, according to *Engineering News-Record*, as against $34,652,000 a week earlier and $75,539,000 a year ago. Contracts for public projects amounted to $21,000,000, as compared with $72,000,000 for the corresponding week in 1942.

Professor Fisher's index of wholesale commodity prices for the week ended Dec. 10 advanced to 11.6 per cent of the 1926 average, as compared with 111.3 for the week before.

Member bank reserves increased $363,000,000 during the week ended Dec. 15, and excess reserves rose $320,000,000 to an estimated total of $1,240,000,000. Business loans of reporting members increased $16,000,000 during the preceding week but stood $9,000,000 below the total a year earlier.





SPARK TEST FOR No. 11 SPECIAL (Straight Carbon Tool Steel)

This spark stream is full and brilliant. It is characterized by a dense stream (1) adjacent to the wheel. Carrier lines (2) are relatively long, continuous, brilliant, almost white. Stream is composed of sprigs (3), preliminary bursts (4) and main bursts (5)—none of them suppressed. There is a marked tendency for the spark to be carried around the peripbery of the wheel.

Put this Useful Spark Testing Guide to Work Today!

PUT SPARK TESTING TO WORK IN YOUR PLANT...

- **to "unscramble" mixed tool steel stocks**
- **to check the identity of tool steel before hardening tools**

If, in spite of all your precautions, stock mix-ups do occur, *Spark Testing* can help you quickly identify an unknown piece of tool steel.

And this method is often used to check the identity of tool steel before tools are hardened. Thus, it helps to insure correct heat treatment on each job.

By simply holding the steel against an emery wheel and watching the colors of the lines and bursts of the spark stream, you get a quick indication of the major elements present. For example, the Carpenter "Guide for Spark Testing Tool Steels" describes the spark patterns caused by major elements such as carbon, tungsten, molybdenum, etc.

This convenient wall chart was prepared by our own testing department, and is designed to assist your men in getting started on *Spark Testing*. It even contains instructions for *Spark Testing* procedure-grinding wheel speeds, etc. With this chart as a guide, the study of *Spark Testing* is greatly simplified and your men can easily become familiar with this method of steel identification.

For your copy of the Carpenter "Guide for Spark Testing Tool Steels", drop us a note on your company letterhead. We'll be glad to give you a copy.

THE CARPENTER STEEL COMPANY
103 W. Bern Street, Reading, Pennsylvania

Carpenter MATCHED TOOL STEELS

U. S. Treasury Invites Bids on 11,000 Surplus Motor Vehicles

Certificate of War Necessity Required to Purchase Equipment to Be Released by Army

The Treasury Procurement Department is currently taking bids on approximately 11,000 motor vehicles, which have been declared surplus by the Army. These vehicles include about 10,000 trucks of 1939 and earlier models, approximately 1000 new 1942 passenger cars and 50 new motorcycles.

The vehicles will be released from various Army installations throughout the country as replacements can be made. Although they will undoubtedly ease the transport difficulty in some small degree there are several steps which have to be taken before these vehicles can be purchased, particularly in the case of the trucks, which are mostly light weight models.

Exact numbers, types and condition of equipment are not known, and since the vehicles will be released in the field it is doubtful whether this information will be tabulated in Washington until final disposition is made.

Regional offices of Treasury Procurement send out invitations to bid on the equipment at OPA ceiling prices in the initial step. Would-be purchasers if they possess a certificate of war necessity, required for operating any kind of commercial motor vehicle, can purchase the equipment offered.

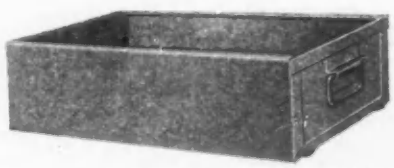
ODT recently issued a warning to prospective purchasers to consult their ODT Motor Transport District Office before bidding on any of this equipment.

Several cases have occurred, ODT said, where persons have purchased trucks and then found the proposed services were of a nature that would not qualify them for allotments of motor fuel and mileage. He should make sure that ODT will issue him one, in order to avoid financial loss.

IMMEDIATE SHIPMENT

STEEL BOXES

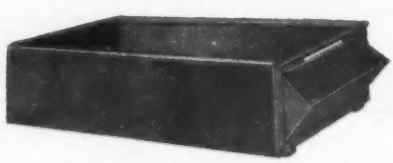
FOR YOUR PRODUCTION NEEDS



STYLE 300 STACKING BOX

Just right for your small parts. Light in weight, easy to handle. Equipped with drop handles each end. Runners save wear on bottom of box, and act as postive stacking lock.

No. 303 9" x 13½" x 4½"—19 ga. $.75 Ea.



STYLE 700 STACKING BOX

A light weight box designed for quick identification of contents. Will Stack with No. 303. Finished olive green enamel, baked on.

No. 703 9" x 13½" x 4½"—19 ga. $.95 Ea.

STYLE 600 STACKING BOX

An ideal all-purpose shop box. Sturdy all-welded construction. Heavy skids set as positive stacking lock and re-inforce box at point of maximum wear.

No. 601 10" x 16" x 6"—18 ga. $.95 Ea.

STYLE 500 STACKING BOX

Perfect for the handling of small parts. Open front makes contents easily accessible when boxes are stacked. Will stack with No. 601.

No. 501 10" x 16" x 6"—18 ga. $1.15 Ea.

Prices F.O.B. Factory, Phila.—Any Quantity!
Order Today—Write, Wire or Phone

AMERICAN METAL WORKS, INC.

1537 Germantown Avenue, Phila. 22, Pa.

"40 Years of Service" By Continental Rubber

"Forty Years of Service," a tribute to industrial rubber products and to a pioneer in their manufacture, has just been published by the Continental Rubber Works, Erie, Pa., to mark the fortieth anniversary of the founding of the organization. The history of the business is closely connected with the pioneering work which Theron R. Palmer, president and founder, devoted to the progress of the industrial goods industry, and this is reflected in text and illustration in the book.

Carrying no by-line, the work is assumed in the industry to be the creation of the founder's son, the secretary of the company, Charles Jarecki Palmer, named after the company's first secretary. The present board of directors is still headed by Theron R. Palmer, and it contains three of the original directors, while the sons of three more of the first directorate have succeeded to their fathers' places on the board. Some of the original men and many of their descendants are still in the company's employ, the book states.

Other present officers are: Paul H. Henkel, vice-president and general manager; Herman M. Reinecke, treasurer; Florence R. McCarty, assistant general manager, and Mervyn M. Schade, assistant treasurer.

Carboloy Reduces Prices

As a result of additional manufacturing economies in the mass production of standard single point tools Carboloy Company, Inc., has once more reduced prices on its cemented carbide tools.

It is one of the most fascinating riddles of our time. For powerful telescopes have brought to light a strange network of "canals" on the planet's surface . . . Magnifying a celestial spark to the size of the moon, the power of light and a lens reveals facts never before suspected.

We have a parallel to make that is likewise interesting, and may be of importance to you. We manufacture an industrial instrument known as the Jones & Lamson Optical Comparator. It, too, consists primarily of light and a lens. Its purpose: rapid, accurate inspection.

Now this machine—by means of an enlarged shadow—reveals facts about the nature and the accuracy of parts that are often unobtainable by any other method of gaging.

It makes possible the measurement and inspection of complex surfaces faster, more reliably and more ***easily*** than is possible with any other form of gage.

Because of this, Jones & Lamson Optical Comparators are in use today by leading producers in virtually every line of production . . . and the record of these machines in helping to cut costs and speed production is the important part of the story.

In the change-over ahead, Jones & Lamson Optical Comparators are going to be of tremendous value. Why not get ready now to meet—and beat—fierce postwar competition? Jones & Lamson Inspection Engineers can help you. Call on them now.

JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

Profit-producing Machine Tools

PERSONALS

(*Continued from page 50*)

The Wickwire Spencer Steel Co. has announced the appointment of **Robert T. Dunlap** as general superintendent of the Buffalo Works of the company.

The appointment of **K. F. Boldt** as advertising and sales promotion manager of the American Phenolic Corp. has been announced.

Kinney Aluminum Co. has announced the appointment of **Stuart H. Betsinger** as sales manager of the company.

R. L. Vaniman, whose resignation as director of the Automotive Division of WPB became effective Jan. 1, has been appointed vice president in charge of exports for Fruehauf Trailer Co. Vaniman was with the Export Division of Chrysler Corp. for 13 years before joining WPB early in 1942.

James D. Cunningham, president of the Republic Flow Meters Co. and the Autogas Co., has been elected a director of Allis-Chalmers Mfg. Co.

Walter S. McLucas, board chairman of the National Bank of Detroit, has been elected a director of Bendix Aviation Corp.

R. M. W. Shaw, former liaison man with WPB between Washington and the regional offices, has been named advertising manager of Graham-Paige Motors Corp. Before the war he was assistant sales manager of Oldsmobile and general sales manager of Willy-Overland.

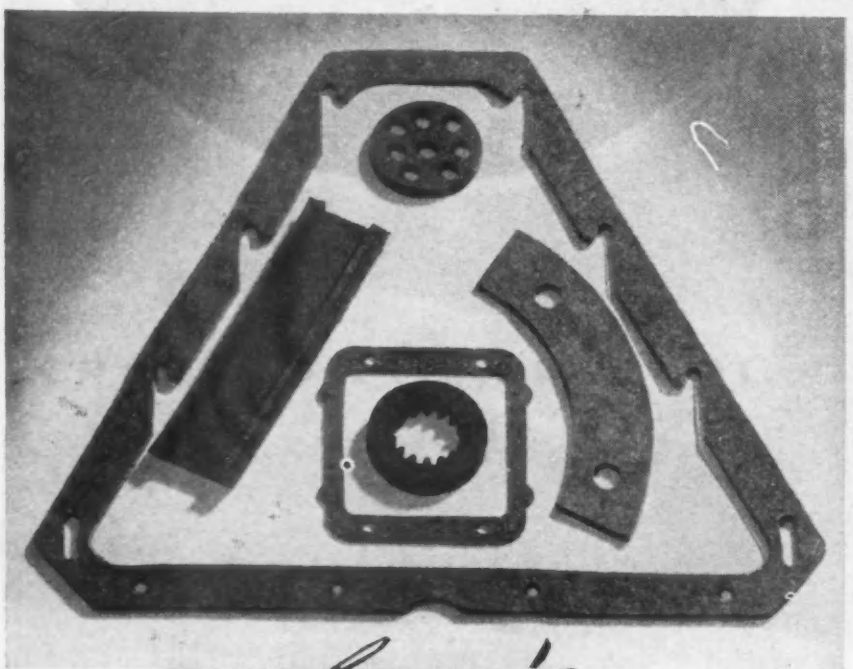
H. E. VanPetten has been appointed manager of the B. F. Goodrich Co. advertising division in charge of advertising of tires, industrial products and koroseal. He succeeds **George F. Cozzens,** who has joined the Army, in charge of tire advertising.

Donaldson Brown, vice chairman of General Motors Corp.; **Harvey S. Firestone, Jr.,** president of Firestone Tire & Rubber Co., and **Sydney G. McAllister,** chairman of the executive committee of International Harvester Co., have been elected directors at large of the National Association of Manufacturers.

Paul E. Tis, assistant manager, has been promoted to manager of the Studebaker Corp. export office, succeeding **D. J. Elmore,** resigned.

Ross Miller, formerly factory expediter in Philadelphia, has been appointed service manager and also placed in charge of production scheduling of service parts in the Hoist and Body Sales Dept. of Gar Wood Industries, Inc. He succeeds **L. F. Avery,** who becomes resident expediter in western Pennsylvania.

Col. Harry Adamson, formerly commanding officer of the Fort Crook (Neb.) Ordnance Depot, has been named commanding officer of the Fort Wayne Ordnance Depot, Detroit. He succeeds **Col. Ray M. Hare,** who has been appointed chief of the Storage Branch, Field Service Division, on the staff of **Maj.-Gen. L. H. Campbell, Jr.,** chief of ordnance, in Washington.



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Where the job demands insulation, resiliency, sound deadening, flexibility, compressibility, resistance to age, heat and water, and many other properties, Western can recommend felt as one of the most versatile materials in existence.

45 years' experience in manufacturing superior quality felt to the closest specifications qualifies Western to meet *all* challenging new uses for the widely used material. Our engineering staff is prepared to assist *you* on any problem involving the possible use of felt. *Write us today.*

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WESTERN *Felt*

Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felts

PUBLICATIONS

A brochure entitled **Cutting Fluids** has been issued by the Standard Oil Co. of N. J. It covers such matters as the selection of cutting fluids, industrial dermatitis, machinability ratings of steels, Government specifications of wartime steels and a listing of Esso cutting fluids. Valuable suggestions also are given as to the best utilization of cutting fluids of various types.*

Doall Service Co. has issued a new booklet called **Production Today with Doall Products.** It is a 36-page booklet and illustrates and describes briefly the complete line of new industrial tools under the Doall name.*

A **Special Tool Handbook** that includes illustrations and mechanical drawings of high speed steel cutting tools has been issued by the U. S. Tool & Mfg. Co. Tools included are milling cutters, forming tools, end mills, reamers, counterbores, etc.*

Calumet Refining Co. has published a new booklet commemorating its 25th Anniversary, called **25 Years With One Ideal.***

Steam Supply Systems and Curing Schedules is the title of a 20-page booklet issued by United States Rubber Co. It explains why the proper steam supply system can accurately control the cure and greatly increase the quality of the average shop's synthetic repairs and recaps.*

Chain Bolt Co. has issued a new catalog describing the **Rex Speed Prime Pumps.** It gives complete information concerning the mechanical parts and construction of the pump, how it operates and what it will do.*

Maintenance Arc Welding, published by The James F. Lincoln Arc Welding Foundation, is comprised of 25 award papers from the Industrial Progress Award Program, 1940-42. The information contained in the new volume will be found particularly useful in keeping machinery and plants in operation despite critical shortages in materials and equipment. The price per copy is 50 cents and can be obtained by writing The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio.

Ignition mercury-arc rectifiers for 501 kw and higher ratings, 250 to 900 volts, are featured in an attractive new 36-page bulletin recently issued by the General Electric Co. It is well illustrated and lists many advantages of these rectifiers for converting alternating current to direct current in plants of various types.*

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

LAST MONTH HE WAS SANTA IN THE TOY STORE

THIS MONTH HE TOOK HIS

GRANDSON'S PLACE

AND HE'S DRIVING SCREWS LIKE A 21-YEAR OLD.

FOR THE PLANT WHERE HE WORKS USES THE RECESSED HEAD SCREW

THAT MAKES DRIVING DUCK SOUP...

IT'S PHILLIPS →→→→

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It's the Phillips Recessed Head Screw that does the trick! With Phillips Screws, the greenest operator quickly becomes as skillful as a veteran. No fumbling . . . no wobbly starts . . . no slant-driven screws or dangerous screw driver skids. Workers turn out flawless jobs every time — and faster than ever before. Time studies prove that Phillips Recessed Head Screws step up screw driving speed as much as 50 per cent!

Imagine what this means to you in terms of man-and-training-hours saved . . . of increased production . . . finer workmanship. Then match these important advantages against slotted head screws — or any other type you may be using.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

Faster Starting: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Easier Driving: Turning power is fully utilized. Workers maintain speed without tiring.

Better Fastening: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.

IDENTIFY IT!

Center corners of Phillips Recess are rounded . . . NOT square.

Bottom of Phillips Recess is nearly flat . . . NOT tapered to a sharp point.

23 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

CASE HISTORY
This single Kold-Hold Sub-Zero machine handles the output of expansion fit cylinder liners for four furnaces. Double the capacity of former equipment.

Productioneered

BY KOLD-HOLD

Typical of Kold-Hold "Productioneering for Industry" is this experience of a large automotive and aviation manufacturer (name on request).

Faced with a tough, costly bottleneck, Kold-Hold "productioneered" a cold processing unit to fit the manufacturer's problem . . . the results were — production per hour doubled, serious bottleneck broken, closer fits attained and distortion eliminated. This is an outstanding Kold-Hold "productioneering" performance.

Maybe you have a similar "toughie." A look through our catalog, S-Z 431, may show you a machine that will fit your cold temperature application. Tell us about it and we'll help you "productioneer" your production problem. Kold-Hold machines over a range of from —100° to +200° on capacities from 2 to 400 cubic feet. If pressure and humidity control are required, we have them, too.

KOLD-HOLD

**Engineered for Production*

453 NORTH GRAND AVENUE • LANSING, 4, MICHIGAN

Landing Craft Program

(*Continued from page* 46)

The production schedule of trucks of 2½ tons and upwards for 1944 calls for an increase of 105 per cent over the 1942 program. Output in 1943 was only 19 per cent above 1942 and the rate in the fourth quarter last year was 42 per cent above the 1942 rate. With the Army's emphasis on all-wheel drive, this calls for an expansion of axle-making facilities. To this end, Standard Steel Spring Co. is converting a DPC plant at Madison, Ill., for an $89,468,910 subcontract from Timken-Detroit Axle Co. for 9600 sets of axles for four-ton trucks, 14,400 axles for six-ton trucks and about $15,000,000 worth of spare parts. In conjunction with this expansion, Saginaw Malleable Iron Division of GM will operate a $2,000,000 plant at Danville, Ill., to be built by DPC, for the manufacture of malleable castings for heavy duty truck axles. This plant will contain 130,000 sq. ft. and employ 500 persons. Oldsmobile Division of GM also is expanding its forge shop capacity at Lansing to supply 2000 additional tons of forgings monthly.

C. E. Wilson, vice-chairman of WPB, recently indicated the size of the 1944 armament program before the NAM at New York when he said that munitions schedules this year call for total output 136 per cent in excess of the 1942 production. This is only a slight rise from the rate prevailing in the fourth quarter of 1943, which was 124 per cent above 1942. Ground army ordnance and signal equipment, which was 63 per cent ahead of 1942 output last year, will be only 67 per cent above the 1942 rate in 1944. Tank production in 1944 will decline to 75 per cent of 1942 output compared to 113 per cent in 1943. Small arms ammunition, which last year was up 142 per cent over 1942 production, will show only a 45 per cent increase in 1944 over the '42 rate. Artillery ammunition, however, will climb 182 per cent above the 1942 rate in 1944. The 1943 total was 120 per cent above 1942's.

Aircraft production on a tonnage basis calls for the greatest increases in 1944. This year's program is scheduled to be 326 per cent above 1942 output, when 47,694 planes were produced. The 1943 total was 143 per cent above 1942, tonnage-wise, with 76,876 military planes manufactured in the 11 months through November. However, fourth quarter production was at an annual rate 238 per cent greater than 1942. The greater ouput on a weight basis is due to the heavier proportion of four-engine bombers and decreasing percentage of trainers. November saw 8789 planes roll off U. S. production lines, of which more than 1000 were 4-engine bombers—B-17s, B-24s and a few B-29s. Pacific Coast airframe manufacturers turned out 2581 planes in November, 29 per cent of the national total, and of these some 600 were heavy bombers.

When writing to advertisers please mention AUTOMOTIVE *and* AVIATION INDUSTRIES

Compact in design—sturdily constructed—foolproof in operation—this powerful DeWalt will *speed up* your cut-off operations not only in today's emergency but long after the war is over. Write for descriptive literature.

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PRODUCTS CORPORATION
LANCASTER, PA.

Annual Meeting of SAE

(*Continued from page* 52)

plane Engines," John P. Flannery, Aircooled Motors Corp.; "Aircraft Powerplant Development Testing," J. O. Charshafian, Wright Aeronautical Corp.

MATERIALS — "Quality Control of Engineering Materials During Manufacturing and Processing," R. H. McCarroll and J. L. McCloud, Ford Motor Co.; "Effect of Wartime Developments on Future Steels and Their Uses," W. P. Eddy, Jr., Yellow Truck & Coach Mfg. Co.

SAE WAR ENGINEERING DINNER—"Lessons Learned From Captured Automotive Materiel," Major-General G. M. Barnes, Ordnance Dept.

January 13

DIESEL ENGINE—"Diesel Engine Design Trends from War Experience of the U. S. Navy," E. C. Magdeburger, Bureau of Ships, Navy Dept.; "Development of a Single Plunger Injection Pump for a Four-Cylinder Diesel Engine," R. Bowers and R. E. Peterson, International Harvester Co.; "Porous Chromium for Engine Cylinders," H. Van Der Horst and R. Pyles, Van der Horst Corp. of America; "Some Physical and Wear Characteristics of Porous Chromium Plated Piston Rings," T. C. Jarrett, Amer. Hammered Piston Ring Div., Koppers Co.; "Summary of Technique of Chrome Plating of Cylinder Barrels," B. A. Yates, McQuay-Norris Mfg. Co.

AIRCRAFT—"The Postwar Private Airplane," W. D. Hall, Aeronca Aircraft Corp.; "Postwar Private Flying," J. H. Geisse, Civil Aeronautics Administration.

FUELS AND LUBRICANTS—"Lubricating Oil Qualification Tests for Ordnance Engines," Capt. W. B. Bassett, Ordnance Dept.; "Military Development of Greases," Major N. W. Faust, Ordnance Dept.

PRODUCTION—"Getting a Better Grip on Quality Control," John Gaillard, American Standards Association.

AIRCRAFT AND AIRCRAFT ENGINE—"Structural Flight Research," W. L. Howland, Lockheed Aircraft Corp.; "Experimental Flight Testing from the Aircraft Engine Manufacturer's Viewpoint," L. C. Miller, Wright Aeronautical Corp.

January 14

FUELS AND LUBRICANTS — "A Study of V/L Characteristics of Motor Gasoline and the Application of Vapor Lock Problems in Land Vehicles" (Report of Automotive Vapor-Lock Subcommittee of the Coordinating Research Council), E. M. Barber, A. E. Robertson and E. W. Aldrich; "Cooperative Studies of Fuels and Fuel System Phenomena Contributing to Aviation Vapor Lock" (Report of Aviation Vapor-Lock Sub-committee of the Coordinating Research Council), R. Albright and A. E. Robertson; "Vapor Lock, or Dumb Engineering," R. J. S. Pigott, Gulf Research and Development Co.; "Vapor Lock Tests on Ordnance Transport and Combat Vehicles," W. G. Ainsley, Consultant, Ordnance Dept.; "Altitude Vapor Formation in Aircraft Fuel Systems," W. H. Curtis and R. R. Curtis, Thompson Products, Inc.; "A Method for Testing Cutting Oils," H. L. Moir, J. S. Yule, D. J. Wangelin and R. J. Moyer, The Pure Oil Co.; "Mobilized Research," C. B. Veal, Secretary, Coordinating Research Council.

AIRCRAFT — "Mechanical Characteristics of Plain Low Carbon Steel Sheet and Strip," H. L. Von Ende, Carnegie - Illinois Steel Corp.; "Rational Design of Fastenings," E. S. Jenkins, Curtiss-Wright Corp.; "Production Design Changes in the C-47 Airplane," D. L. Moseley, Douglas Aircraft Co., Inc.; "Transoceanic Air Cargo," Lt. Com. Neil Maccoull, U. S. Naval Air Station, Lakehurst, N. J.; "All-Weather Flight Methods," R. S. Johnson, United Air Lines Transport Corp.

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By building better for war, American Industry is learning how to build still better for peace. Out of mammoth production of efficient engines and tools of destruction, will come new safety and comfort, new conveniences and economy for secure and happy living . . . Aetna's own experience is typical. We have made Precision Bearings by the millions—for implements of war. Out of intense ceaseless effort to build better and faster, have come new techniques and methods, new short-cuts and savings.

We have built not only bigger bearings, but better ones. We've applied them to new uses. We've found how to make them efficiently, faster and at a lower cost. . . . How these new and better ways can be practically applied to your own pleasant peace-time activities is a subject we'll enjoy exploring with you — when you are ready. Aetna Ball Bearing Manufacturing Company, 4600 Schubert Avenue, Chicago, Ill.

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Grinding Main Housing Poles for Magnetos on a No. 18 Blanchard Surface Grinder

Ability to remove metal quickly and cheaply makes it possible for Blanchard Grinding to carry through from roughing to finishing in one operation.

These Housing Poles for magnetos have .140" stock to remove from steel laminations. Ten pieces are held on a Blanchard designed fixture on the No. 18 Grinder and 30 pieces are finished per hour.

The weight and rigidity of the Blanchard are essential for economical machining of parts such as these.

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

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BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

Quality Control Through Teamwork

(*Continued from page* 40)

is transferred to it from the blue copy of the Inspection Discrepancy Report, and it is addressed to the department and to the attention of the individual believed to be responsible for the correction of the discrepancy. This form is very similar to the Inspection Discrepancy Report, in that it carries much of the same information, but in addition a space is provided at the bottom for the quality manager's recommendations for correction. The Quality Control Discrepancy Report is prepared in duplicate; the original is immediately delivered (not mailed) and the carbon copy is attached to the blue copy of the Inspection Discrepancy Report and placed in the Quality Control Supervisor's follow-up file.

As it is important for the Quality Control Department to know at the earliest possible moment what action is being taken by the department to which the report is directed, a third form, Reply to Discrepancy is prepared in part by the Quality Control Department and attached to the Quality Control Discrepancy Report before delivery. This form is addressed back to the Quality Control Department. It also carries the serial number of the Inspection Discrepancy Report, the assembly number, the assembly name, etc. In the lower portion of this reply form, a space is provided to show what action or corrective measures are being taken. Since the upper portion of the form is prepared by the Quality-Control Department, the person to whom the report is addressed need only indicate the action taken, fill in the date, sign and return (not mail) to the Quality Control Department. Upon receipt of this reply, it is turned over to the Quality Control Supervisor, who ascertains that the action taken is satisfactory. If such is the case, he initials the reply in the upper right-hand corner, removes the file copies of the Inspection and Quality Control Discrepancy Reports from the follow-up file, attaches the reply thereto and hands them over to the Quality Manager. It now becomes necessary to notify the inspection office, to which the original of the Inspection Discrepancy Report was addressed, the customer's inspector who is holding the green copy in his file, and the company inspector, in whose file the yellow copy is being held—that satisfactory corrective measures have been taken to avoid further rejection. This is accomplished by an inter-office memorandum prepared by the quality control office, the original of which is addressed to the company inspector who reported the discrepancy, with carbon copies to the customer's inspector and to the company inspection office. The quality control office file copy of this memorandum is attached to the report; the report is then logged as complete and transferred to the inactive file.

This paper work may seem complicated but in reality it has proved very simple. In order to show how long it takes to clear up an unsatisfactory condition by this method a few specific cases will be analyzed. On one occasion, an Inspection Discrepancy Report was prepared by the First-Article Inspector in the machine shop and time-stamped 10:07 a. m., February 8. The blue copy of this report was delivered to the quality control office and time-stamped 10:10 a. m. It was passed on to the quality control factory liaison group immediately. At 10:20 a. m. it was returned to the quality control office, with the result of the liaison man's investigation noted on the back. A Quality Control Discrepancy Report showing a recommendation for corrective action, together with the Reply to Discrepancy Report form, was preared and delivered to the production department. The latter took action immediately and indicated on the Reply to Discrepancy

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U. S. Navy Official photograph

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make short stops safe

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Continuing research in development of greatly improved formula by American Brakeblok's engineering staff has stepped up the efficiency of brake lining materials for use in aircraft. Today, operational results are available that prove the new Aircraft Brake Lining equal to the test.

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"STOPPER THE PUP"—American Brakeblok's whimsical character, is recognized by motorists everywhere as the symbol of safe brakes.

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DIVISION OF AMERICAN Brake Shoe COMPANY

From 130° Above to 60° Below Zero

Wartime use of aircraft, in the deserts of Africa, in the frozen far North . . . flying from scorching earth to sub-zero temperatures of extremely high altitudes in a few minutes' time . . . these conditions have created a definite need for dependable, automatic temperature control devices . . . in these wartime planes, in jeeps, trucks and other fighting equipment Chace actuating elements are providing constant and reliable control of important temperature responsive devices.

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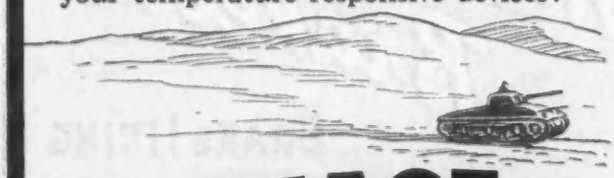
And for postwar activities, remember Chace utilizes 25 different alloys to produce 35 different types of thermostatic bimetals. May we suggest the type most suitable for the actuating element of your temperature responsive devices?



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Manufacturers of

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Report that the condition had been corrected in accordance with the recommendation. This reply was delivered to the quality control office by messenger at 10:25, at which time the inter-office memorandum was prepared, and it was delivered to the proper persons before 10:30 a. m. Therefore, in this case a correction was made in less than 25 minutes from the time the trouble was discovered.

This particular case related to "sloppy" drill bushings in a drill jig. It came to the attention of the First-Article $nspector and was corrected with the loss of only three parts.

Another case believed to be worth recording was an epidemic of corrosion in the plant. It showed up first on aluminum alloy material, after forming, but subsequent to inspection and acceptance of the finished parts. It occurred also on items in the finished-parts stores, as well as in finished assemblies. In spite of extra precautions in heat-treating, handling, and storing the parts susceptible to corrosion, the condition became worse. The Inspection Department and all quality control personned were instructed to be on the alert for any clues which might lead to the solution of the problem. Within a short time a Discrepancy Report was received from the Sheet-Metal Department, first-article inspection. It indicated that minute, foreign particles had been imbedded in the surface of a formed rib, and that a slight discoloration seemed to encircle each minute particle. The inspector added a footnote to the effect that "It is not believed that this condition could in any way contribute to our corrosion problem, but it is unusual, and we have been instructed to report all unusual surface conditions no matter how insignificant they may seem to us."

This Discrepancy Report proved to be a vital clue to the solution of the problem. The sample was rushed to the laboratory and it was found that the foreign particles were minute iron particles, and that there was corrosion around each tiny particle.

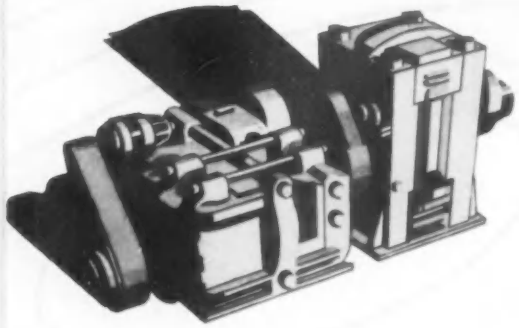
Other samples picked from the finished-parts stores, the production line, and from various other places showed no indication of contamination to the naked eye, but when examined under a microscope, they likewise proved to be affected. This led to the belief that contaminated material was being received, but later when samples of raw materials were tested, this assumption proved to be wrong.

Having found these minute iron particles originated within the factory, steps were taken to determine from what sources they came. It was finally discovered that the parts affected were being formed in the Hydro-press Department. Tests indicated that the air in that department was contaminated with iron articles which collected on the dies and blanks in process. The problem then was to determine from what source these particles could come.

Pearl Harbor!

BY JAMES M. SESSIONS

NO. 1 OF A SERIES "HIGHLIGHTS OF WORLD WAR II" PRESENTED BY TUBE TURNS (INC.) LOUISVILLE, KY SEE OTHER SIDE



WARTIME FORGINGS WIDEN *Tomorrow's* USES

Mechanical warfare—and the gruelling punishment that war machines undergo—has demanded the strength and characteristics of forgings in many unheard of applications. Out of this acid test have come new conceptions of forgings as a metal form. New uses, new types, new metals, new manufacturing accuracy, new design economies—found and proved through the urgency of war production—open interesting vistas to design and production engineers.

What we have to offer—now and after the war—goes beyond our array of large upsetters, mechanical presses and heat treating furnaces. You will find here an unfettered viewpoint, a willingness to tackle new forging problems that can prove useful in your design or production today or tomorrow. *Tube Turns (Inc.), Louisville, Ky.*

Tube Turns presents on the reverse side of this page the first of a series of stirring war paintings created by the well known contemporary artist, James Sessions. "Pearl Harbor" is Sessions' conception of the catastrophe that aroused America.

TUBE TURNS

Forgings for Industry

Suspicion almost immediately fell on the Manifold Tooling Department, which was located adjacent to the Hydro-press Department. Particles picked up on wet blotting paper in the Manifold Tooling Department were found to match those imbedded in the material. Thus the cause of the trouble had been located and the Manifold Tooling Department was moved immediately.

This particular case took 36 hours to correct, but it might have taken several weeks had it not been for excellent cooperation and teamwork throughout the organization.

Another case which portrays the advantages of quality control occurred in the Manifold Department. The floor inspector, in the execution of his routine duties, noticed that two parts on a first-article manifold did not fit properly. Knowing that the material for a heavy production run of these parts was about to be fabricated, he immediately prepared a Discrepancy Report. A routine investigation by the Quality Control Department showed that the difficulty originated in marking the material to cutting templates. The templates themselves were correct, but due to slight waves in the raw material, the exact outline of the template was not reproduced on the sheet itself. Only three sheets of material had been cut when the quality control recommendation took effect.

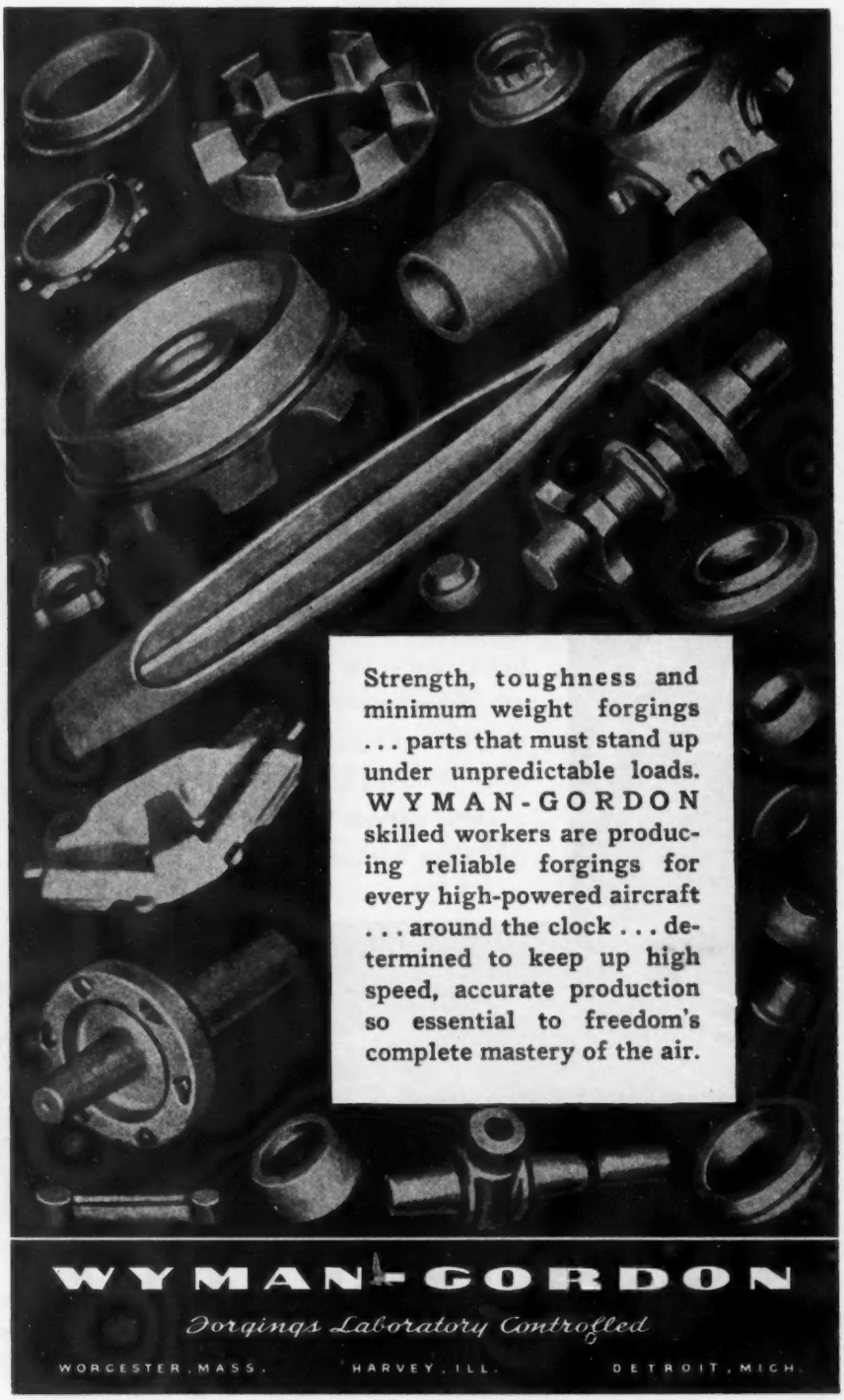
Inspection's Role

Most of the mistakes are discovered by inspectors. It is therefore necessary to have close cooperation between the Inspection Department and the Quality Control Department, and for this reason the Inspection Department was made responsible to the Quality Manager. First-article inspection was found to be an important factor in avoiding rejections of large quantities of parts and material, and first-article inspection booths are set up in various departments throughout the factory. These booths are equipped with precision tools, gages, etc., as required for the rapid inspection of the first articles produced of any production run. The Production Department does not suspend production while these "first articles" are being inspected, but in the event of a discrepancy, immediate action is taken by the First-Article Inspector through the quality control office, where recommendations are made to the production department for correction.

Lack of cooperation usually is due to a lack of understanding. To avoid misunderstandings, the Quality Control Department endeavors to make its purpose well known to every employee. The following incident shows what can be accomplished in the way of obtaining cooperation through patience and perseverance.

One of the production foremen felt that the Quality Control Department and its Discrepancy Reports were worthless, and were only a means of reprimanding him for every little mistake made in his department. It is true that the management in this way learned of all mistakes made in his department, and when these were called to his attention he felt that he was being "picked on" and was extremely reluctant to take any corrective measures to prevent a recurrence of these (as he termed them) "little mistakes." To gain this man's confidence in the Quality Control Department and its purpose, each time there was a discrepancy against this department, a sample part was obtained and the foreman was called into the quality control office and asked for a suggestion to prevent a recurrence. His ideas then were embodied in the Quality Control Discrepancy Report and the latter was handed to him before he left the office. In due time this man began to see the advantages of quality control and teamwork, and today he is one of its staunchest supporters.

It may be asked whether "Quality Control" effects a sufficient reduction in scrap to justify an organization of this kind. The Ryan management answers this question by saying that, although its scrap values always have been a very small percentage of its production, through the efforts of the Quality Control Department it has been


Strength, toughness and minimum weight forgings . . . parts that must stand up under unpredictable loads. WYMAN-GORDON skilled workers are producing reliable forgings for every high-powered aircraft . . . around the clock . . . determined to keep up high speed, accurate production so essential to freedom's complete mastery of the air.
WYMAN-GORDON
Forgings Laboratory Controlled
WORCESTER, MASS.
HARVEY, ILL.
DETROIT, MICH.

reduced at least 60 per cent. For this reason, and because quality control is a sure and systematic means of correcting discrepancies, it feels that such an organization merits its place in the aircraft industry.

Postwar Gasoline

(*Continued from page 27*)

present 100 octane grade.

There is another factor which must be appraised in determining the amount of high octane gasoline components to be available for use in motor gasoline after the war. This is the possibility of a greatly enlarged opportunity to produce chemicals from petroleum. The war has already brought into being one important new industry which depends upon petroleum; namely, the synthetic rubber industry. The same butylene which can be and is used as an important raw material in the production of high octane number blending agents can and is being used for making butadiene for Buna rubber; and the same isobutylene which is also a valued ingredient for iso-octane blending agents is the raw material from which Butyl rubber is made. Butylene, isobutylene and isobutane are active materials from the chemical standpoint and it is very likely that there will be a demand for them by industries other than the synthetic rubber industry. Should the chemical industry develop a sizable demand for benezene, toluene, and xylene, it would be most logical to obtain these materials from the naphtha that otherwise would be available as a high octane base stock for 100 octane gasoline.

Conversion to Motor Fuel Manufacture

It appears that the extent to which high octane number aviation gasoline manufacturing facilities will contribute to postwar motor gasoline quality can be briefly summarized about as follows:

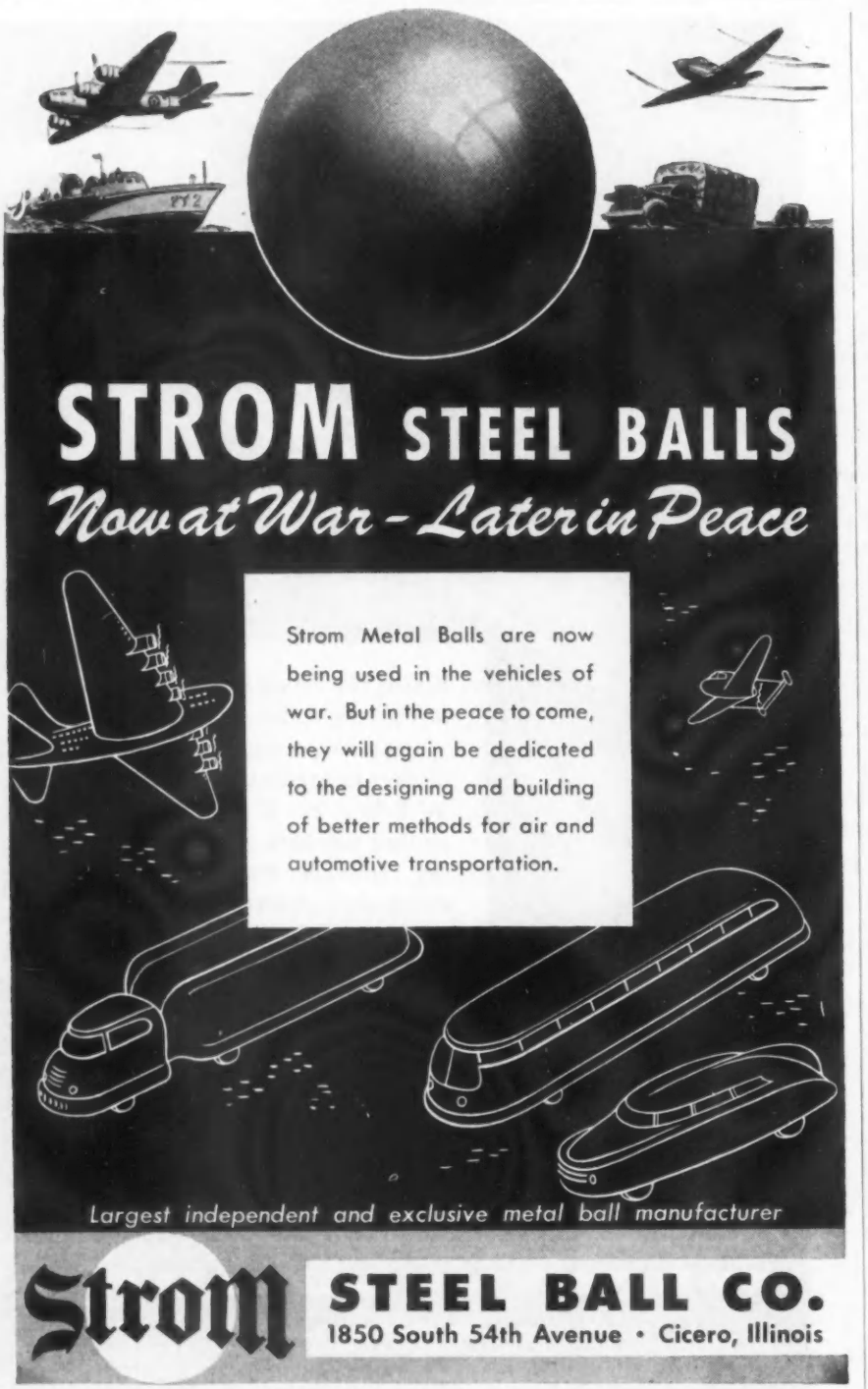
(1) Most catalytic cracking capacity will be converted to the manufacture of high octane motor gasoline as rapidly as possible after the conclusion of the war.

(2) Alkylates and other high octane number blending agents will find their way into motor gasoline only to a comparatively slight extent and then only as their use can be justified as means for vapor pressure control, i.e., as means for incorporating in motor gasoline the high octane number but very volatile butanes and the like which might otherwise be lost.

(3) Polymerization units will no longer produce the expensive codimer required for aviation gasoline use, but rather will revert to their prewar procedures of non-selective polymerization in which they occupy a position similar to that predicted above for alkylation; namely, to increase octane number and in the same sense as means for vapor pressure control.

(4) The various isomerization processes, and also hydroforming, must occupy a marginal position if they are to figure in postwar motor gasoline manufacture at all. Essentially these processes "make gasoline out of gasoline" which, in turn, means that they can be justified only as long as the cost of the operation as a quality improving procedure can be passed on to the ultimate purchaser. It may well be that some of these processes will find a few important applications in the postwar picture, but it is fairly certain that they will not account for any substantial percentage of ultimate motor gasoline production. By and large, therefore, it appears that the effect of the aviation gasoline program on postwar motor gasoline quality can be judged on the basis of the effect of catalytic cracking facilities.

Within the limits of accuracy of the estimates which can be made, it would appear that catalytic cracked motor gasoline will be produced to the limit of capacity of the available equipment,


STROM STEEL BALLS
Now at War - Later in Peace
Strom Metal Balls are now being used in the vehicles of war. But in the peace to come, they will again be dedicated to the designing and building of better methods for air and automotive transportation.
Largest independent and exclusive metal ball manufacturer
Strom STEEL BALL CO.
1850 South 54th Avenue • Cicero, Illinois

THAR SHE BLOWS!

blow hot, blow cold **IT'S AN AXIAL FLOW FAN**

something to blow about

ALL RIGHT—you pick the headline—we're not going to talk about high efficiency axial flow fans this time, anyway. We'll just raise our heads from the drafting boards and assembly benches and test blocks long enough to say, *"Here's a wish for the season's best"*, and to remind you

For happier holidays *next year*, build an extra plane, an extra tank, an extra ship---and buy another War Bond, *this year.*

DYNAMIC AIR ENGINEERING Inc.
LOS ANGELES, U. S. A.
DESIGNERS and BUILDERS of HIGH EFFICIENCY AXIAL FLOW EQUIPMENT

even though this may involve the shutting down of a substantial portion of the older thermal cracking units. If this is done, possibly 25 to 30 per cent of the postwar motor gasoline production in this country may consist of catalytic cracked naphthas as the principal contribution of the wartime aviation gasoline program to postwar motor gasoline quality.

What Increase in the Octane Number of Motor Fuel Will Result?

There are many reasons why we may anticipate a civilian demand for motor gasoline of improved octane numbers. One of these, of course, is that the automobile companies will wish to start with a new slate in order to produce the best type of automobile to be used by our people. It appears to us that in the postwar period, taxes will inevitably be very high and motor fuel will have to carry a large share of this tax. Also, unless there is a marked change in the outlook for crude oil in this country, it appears that in the postwar period we will have every reason to economize as much as possible on the quantity of crude petroleum used for transportation. The automobile and petroleum industries have never been able to stray very far from the fundamental basis of the maximum number of car miles obtainable from a barrel of crude, at the same time complying with acceptable standards of performance. These factors indicate a real demand for an economy automobile as soon as possible after the war. Such an automobile might, of course, take the form of a small light car having a somewhat lighter and more powerful motor of the high compression type and requiring a very high octane number fuel. It appears, however, that certain other avenues for improving economy appear more immediately attractive than that of mere compression ratio increase. We refer, of course, to the now well-recognized method of reducing engine speed and amount of mixture breathed per car mile, and the significant position of the automatic transmission in effecting such improvements. By such means, quite large economies can be effected without recourse to high compression ratios with their attendant high engine and fuel manufacturing costs.

It is our belief that perhaps too much significance has been attached to the expression "100 octane aviation gasoline." Actually, as is well known, the octane number of aviation gasoline while highly important is only one of several equally important qualities. In particular, aviation gasolines must be made to much narrower boiling ranges than are required for automobile use which, in turn, profoundly influences yields obtainable from a given quantity of crude. However, the fact should not be overlooked that 80 octane gasoline is still very good gasoline.

By and large, it appears that about 85 octane number, as expressed by the ASTM procedure, represents the highest knock rating which can be used effectively by automobiles to be available in the immediate postwar period. By the expression "used effectively" we mean automobiles which, by virtue of design, construction, and maintenance, are able to deliver the performance and fuel economy necessary to justify the costs associated with producing fuel of that quality. It has been emphasized by the foremost authorities in the automobile industry that far-reaching fundamental engine design changes will be required to make possible the effective utilization of gasolines much over 85 octane number. The writers, therefore, hazard the guess that in the first postwar year or so motor gasoline will rapidly approach octane levels of about 85 for premium and around 80 for the regular grade. If there are still "octanes to spare," they will probably be used in the deluxe (premium) grade of fuel. It appears, further, that a third grade of lower octane number will still be available at a lower price. These fuels will adequately take care of the highest requirements of the cars producible in the immediate postwar period, as well as the great bulk of prewar designs which, of course, will constitute the preponderant share of cars in use at that time.

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This ONE LENGTH CLAMP WILL MAKE ALL THESE CLAMP SIZES
. . . AND HUNDREDS OF OTHER SIZES
Central UNIVERSAL CLAMPS
Are Used in Production and Service of
Army and Navy Trucks, Tanks, Jeeps, Aircraft, Half-Tracks, Amphibians, Cranes, Marine Engines, Road Rollers, Farm Machinery, Portable Saws, Searchlights, All Types of Radiator Hose, Diesel and Gasoline Motors.
This powerful, self-locking clamp is absolutely perfect for all hose connections. Easiest to use! Has maximum take-up. Comes packed flat in any length to fit any desired range of diameter sizes.
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In conclusion, it is not intended that the foregoing be interpreted as indicating that 100 octane motor gasoline will *never* be feasible as an automobile fuel. Rather, the picture appears to be that immediately after the war the foregoing improvements are definitely practical with succeeding improvements possible but requiring equipment design, development, and construction. In other words, improvements much above the indicated levels will be "evolutionary rather than revolutionary," and the evolution must be predicted with due regard to the fact that at these high octane number levels already prevailing, each succeeding octane number improvement becomes increasingly difficult to achieve.

Mannerstedt 42-Cylinder Aircraft Engine

(*Continued from page* 37)

der to avoid complexity and the innumerable gear wheels that would be required if a conventional system were used. Only one of the seven camshafts has a direct drive from the propeller reduction gear. It is divided at the center, each half being driven separately. Integral with the rear end of the rear half of this camshaft is a crank engaging with a large ring to which it gives oscillating motion. Each of the other six camshafts also has an integral crank at its rear and engaging with the oscillating ring, and as the throw of all seven cranks is the same the six are rotated by the oscillation of the ring.

There are two spark plugs per cylinder. Exhaust valves are sodium-cooled and have stellited seats. Like the inlet valves, their springs are of

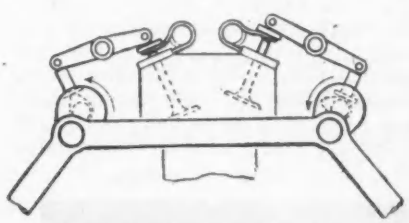


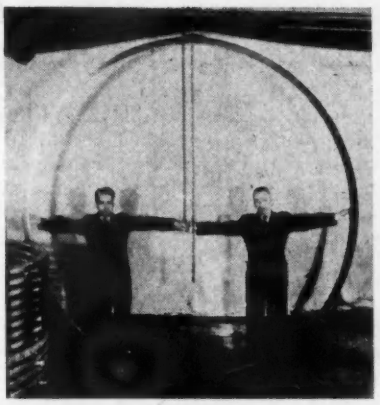
Diagram showing how the valves of the Mannerstedt engine are operated

the hairpin type. Air-cooling is on more or less orthodox radial engine lines, though a somewhat elaborate system of baffles and ducts is needed to guide air over the six rows of cylinders and to secure adequate cooling for the cylinders of the rear unit.

Variation of supercharger gear ratio is effected by a planetary gear. Ratios are 5.85:1 and 4.70:1, giving maximum rotor speeds of 1180 fpm and 945 fpm. It is estimated that maximum engine power will be available at 33,000 ft and ground level induction pressure up to 42,000 ft.

Giant Anti-Friction Bearings

Anti-friction bearings ten feet in diameter, made by the Bantam Bearings Division of The Torrington Company, present a unique contribution to the war effort. These 120-inch diameter races, machined and ground to precision limits of 0.002-inch in diameter and 0.001-inch in parallelism, are for the 5-inch twin anti-aircraft gun mount for the Navy



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THE CENTRAL 360 WIRE HOSE CLAMP

Always A PERFECT 360 DEGREE CIRCLE *Regardless of Pressure Applied*

Unlimited Power

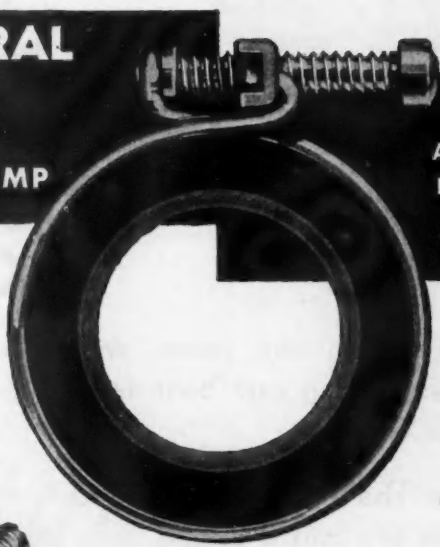
Equal Pressure At All Points

Leakage Impossible

Speeds Production

Tightens Instantly

Unconditionally Guaranteed



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A NEW, MECHANICALLY PERFECT CLAMP FOR WATER, OIL, GASOLINE, AIR AND HIGH PRESSURE HOSE CONNECTIONS.

Unlike other preformed clamps, the CENTRAL 360 *remains* a constant perfect circle with equal clamping pressure at all points, regardless of amount of pressure applied. The tightening element features a powerful combination of simultaneous "push" *plus* "pull". Clamping power, even on synthetic hose, is unaffected by rough castings or variations in hose diameter and resistance. Construction is simple, fool-proof and powerful. It can be attached or removed without disconnecting hose line.

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VISIT OUR BOOTH, NO. 214, AT THE AAMA EXPOSITION, JAN. 31 TO FEB. 3

New Products

(*Continued from page* 44)

regulation is provided by coarse and fine adjustment knobs connected to a built-in variable voltage transformer. An ammeter shows the proper and safe current required for the Globar heating elements, while temperature is indicated by a pyrometer which is connected to a platinum thermocouple. A knob for controlling flow of oxygen operates a needle valve connected to rubber tubing adapters located at both ends of the housing for convenient piping to oxygen supply. A line cut-off switch, and a signal light which shows when furnace is operating, are both included with the control.

These units are equipped with 3 adapters for interchangeability of standard combustion tubes, 1 in., 1¼ in. and 1½ in. o-d. A fourth tube, 2 in. o-d, can be used without an adapter.

Furnaces are built for operation using 60 cycle a-c at 110 or 220 volts. Units to operate at 25 cycle current can be supplied.

Give 'em the Steel
HOT and COLD
For more than two years, we at Atlas have been giving our best in the great war push.
And now that results are beginning to show, we are more eager than ever to follow through with the punch that will down the Axis, once and for all.
Amid the smoke and steam and thunder of our hammers, the fierce heat and glare of our furnaces, we are in the thick of things and we won't let up till it's over over there.
BUY WAR BONDS
ATLAS
DROP FORGINGS
ATLAS DROP FORGE COMPANY • LANSING, MICHIGAN

Fluorescent Luminaire for Industrial Lighting

Designed for easy continuous strip installation, a new light-weight Fluorescent Luminaire with one-piece, double-length hood and two full-size reflectors has been placed on the market by Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

Available for use with four or six 40-watt or four 100-watt Mazda F lamps, the new Type F N C luminaire is the equivalent of two conventional units. The hood is fabricated from

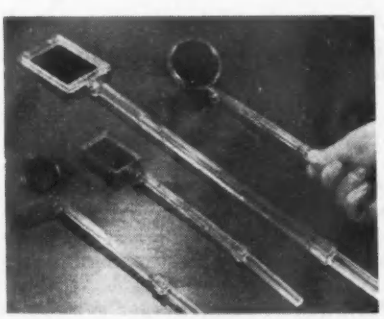
Westinghouse double-reflector continuous strip Luminaire

sheet steel with all ballasts, lamp holders, and starter sockets mounted and wired as part of the channel assembly. New sliding hangers permit suspension from any part of the hood. Mounting arrangements are available for any application.

The moisture-resistant, non-metallic reflectors are covered with a multi-coat polymerized finish which provides a reflection factor of 85 per cent or more. Wing-lock permits removal of reflectors for cleaning.

Skin Protects Parts During Shipment

A new translucent "skin" for protecting machine parts in shipment has been developed by The Dow Chemical Company, Midland, Mich. The product, which has an ethylcellulose base, is a plastic-like substance which is applied by a simple hot dip process; sets into a tough, skin-tight coat in a few seconds that fully protects the metal from rust, corrosion and dirt during shipment. Assembly crews find it strips off quickly and easily with no more equip-

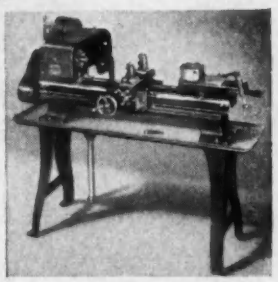


These lightweight inspection mirrors are made of Lumarith plastic. A sliding rod, operated by a small knob, adjust the mirror to the angle required. F. P. Kretchmer, Los Angeles, Cal., is the distributor for these units

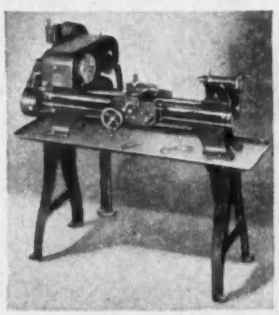
BACK GEARS ENCLOSED IN HEADSTOCK

With Patented Shifter Rack

Finger Tip Control for Easier, Faster Back Gear Shifting



No. 850 Manufacturing Lathe



No. 200 Back Geared Screw Cutting Lathe

The advanced back gear design permits placing the patented back gear shifter rack where it belongs . . . at the operator's finger tips. No longer is it necessary to reach over the headstock to operate the lever which shifts power to back gears. Not only is the position of the back gear shifter rack safer and more convenient, but it also saves valuable seconds every time the shift is made. Finger tip accessibility of the back gear shifter rack is just one of many reasons why you find Logan Lathes in shops with outstanding production and safety records. Note the wide and durable semi-steel back gears. Write today for information on all models of Logan Lathes.

Brief Specifications: **Swing over bed, 10½" • Between centers, 24" • Bed length, 43⅛". • Spindle hole, 25/32" • Precision ground ways: 2 prismatic V-ways; 2 flat ways • 12 spindle speeds, 30 to 1450 r.p.m. • Protected by ball-bearings or self-lubricating bronze bearings.**

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES

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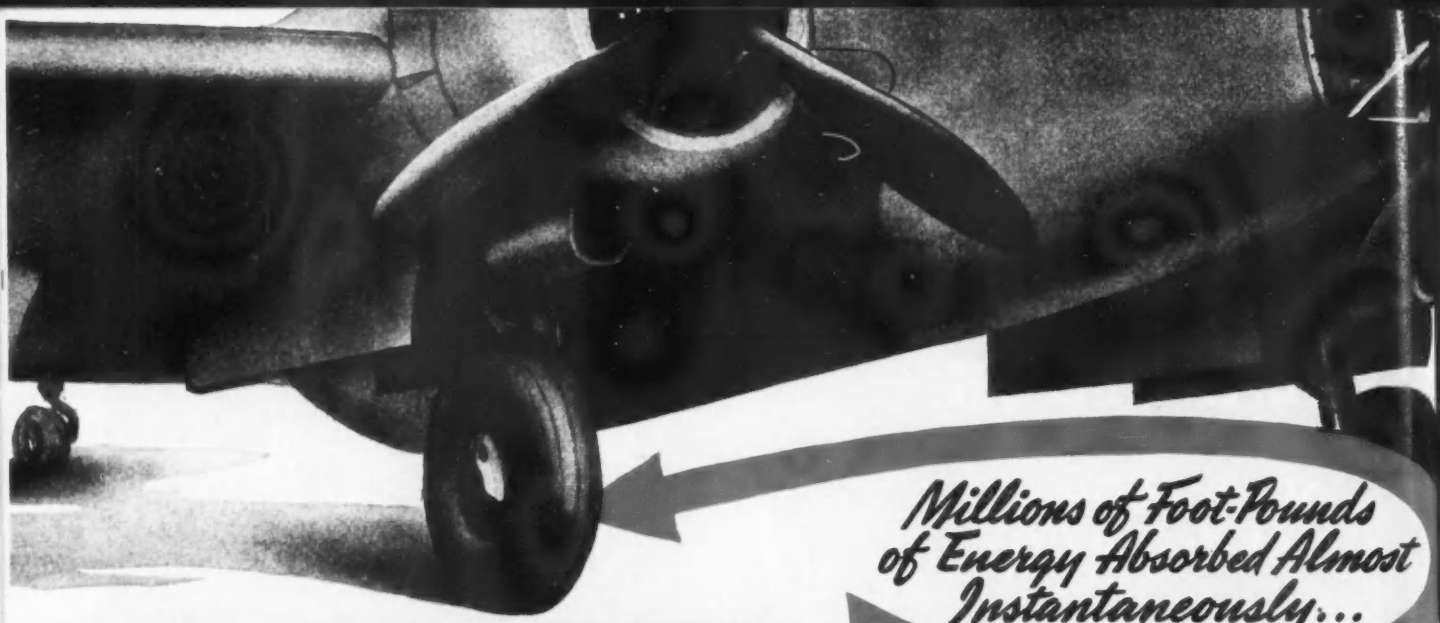
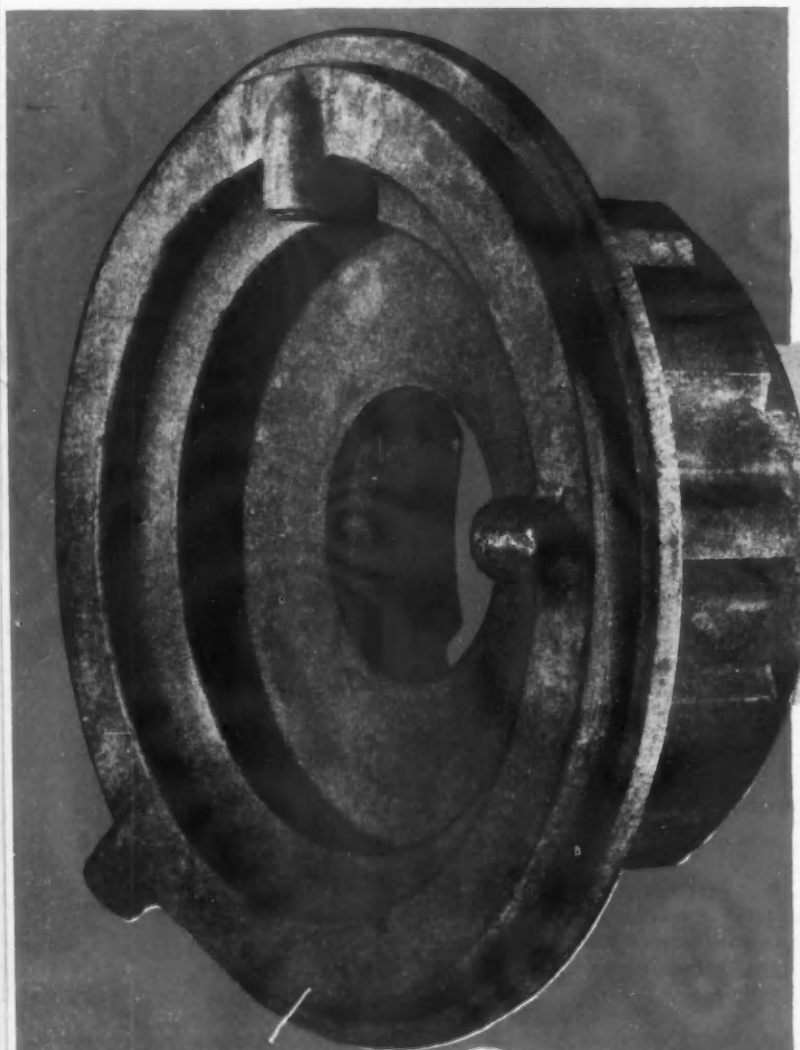


Millions of Foot-Pounds of Energy Absorbed Almost Instantaneously...

by these

GOODYEAR

BRAKE AND WHEEL ASSEMBLIES



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DOWMETAL MAGNESIUM ALLOY SAND CASTINGS

Are Incorporated in these Units

The anchor bracket shown at left is a typical example of the variety of castings our Foundry is called upon to make. This bracket is an essential part within Goodyear Brake and Wheel Assemblies for planes and must possess such structural perfection as to withstand extreme shock, pressure and strain, combined with sudden temperature changes.

Hills-McCanna has majored in unusual casting problems over many civilian years and our organized knowledge, experience, and equipment enable us to produce magnesium alloy castings required for any vital war need.

Let Us...

study with you the possible application of Hills-McCanna Dowmetal Magnesium Alloy Sand Castings to any essential parts of your own peacetime products.

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PROPORTIONING PUMPS · AIR & WATER VALVES · CHEMICAL VALVES
MARINE VALVES · FORCE FEED LUBRICATORS · DOWMETAL CASTINGS

ment than an ordinary pocket knife.

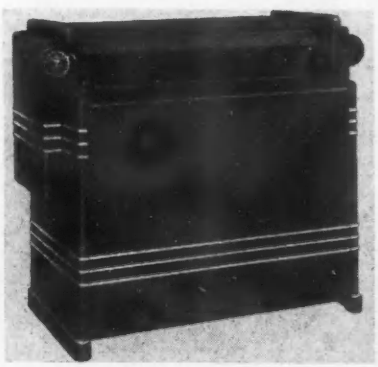
The material used is not yet available for general distribution, being under rigid government control.

The types of parts which can be treated by the new process are not yet completely defined. Its use is already apparent in many cases. Adaptations of method are constantly being extended under rigid military supervision.

So effective is the material in protecting metal from dirt, salt air and salt water, that parts may even be tossed overboard at high tide near invasion points, to be recovered later by repair crews when conditions permit.

Intermediate Size Revolute Printer

The Revolute 8Q Printer, a product of the Paragon-Revolute Corporation, Rochester, N. Y., has been designed to meet the requirements of industries whose print production has graduated from small to the intermediate stage.



Revolute 8Q Printer

It occupies small floor space, will expose blueprints, direct process prints, and sepia negatives up to 54 in. wide. Speeds range from 6 in. to 32 lineal feet per minute. It incorporates revolving contact and uses a quartz high-pressure mercury vapor lamp, drawing approximately 75 watts per lineal inch.

Synthetic Material for Capacitors

Lectrofilm, a synthetic dielectric material for capacitors, is a recent development of the General Electric Company, Schenectady, N. Y.

This synthetic dielectric material, which is made of materials available in the United States, can be best applied to the manufacture of most radio-frequency-blocking and by-pass, fixed capacitors used in communications and other electronic equipment. The new product is said to have a greater combination of desirable properties than was previously available in any one dielectric material. It is available in both rolls and sheets and can be used in present capacitor production lines with very little change in equipment or method of manufacture.

In addition, Lectrofilm's strength

BRING 'EM BACK ALIVE

The safety of our daring airmen, as well as the safety of our country depend upon the ability of American built planes to accomplish their missions and return. The most important factor in the amazing superiority of our war planes is their ability to stay in the air and "bring 'em back alive" despite extensive damage. Certainly the countless fastenings which hold these planes together share equal credit with the superb materials and precision American craftsmanship that produce their structural members. Among these rivets, bolts, nuts, screws and special fastenings are millions of HOLTITE precision fastenings — and we are proud of the vital part they play in bringing back America's war birds alive.

The lives of our fighting men hang by a thread, and we are determined that any screw made at Continental will be the best that science and skill can devise.

Illustrations:
Top: Curtis P-40 Tomahawk.
Center: Boeing Flying Fortress.
Bottom: Lockheed Hudson Bomber.

CONTINENTAL SCREW CO. New Bedford, Mass., U.S.A.
BUY MORE WAR BONDS

and flexibility make it well-suited to automatic methods of manufacture. The careful control used in its production, together with its chemical stability, assure uniform properties and freedom from defects. Furthermore, it requires little grading or sorting before being placed into a capacitor production line.

New Slide Rules Now Available

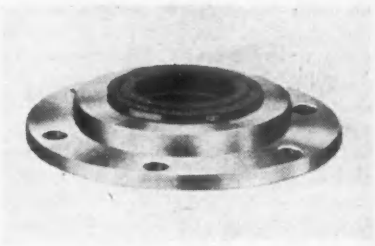
The Frederick Post Company, Chicago, Ill., has just recently made available three new slide rules—one for the professional draftsman, one for the apprentice draftsman or student and also a handy five-inch pocket slide rule.

All three of the rules contain the scales A, B, C, D, CI, K, S, L and T. With exception of the apprentice rule they are celluloid faced—the apprentice rule has a painted face.

These rules have been produced as an emergency measure to meet the large demand for such products. They are said to be well constructed and accurate. A case and an instruction sheet are supplied with each rule.

Sealing Units for Rotating Shafts

A self-contained, self-aligning, low-loss seal for rotating shafts has been brought out by Federal Seal Company, Kendallville, Ind. It is called the Master Seal and is made in two styles, the flange type and the press type, the latter being assembled in a pressed steel case. The maker states that the Master Seal is adaptable for use on aircraft electric motors, oil pumps, gasoline pumps, hydraulic equipment, and accessory drive shafts.



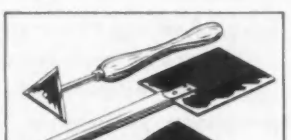
Flange type Master Seal

Beryllium Copper Bites Into Steel

It is an old saying that when a dog bites a man it is not news, but when a man bites a dog it is news. That being the case, it is certainly news when copper bites into steel. Copper is, of course, one of the softer metals but when 2 percent beryllium is added to copper, its characteristics are changed. The alloy is heat treatable which explains the remarkable strength and hardness. Hit a chisel made of Beryllium Copper with a hammer and it will bite into steel without dulling the edge. Tools made of Beryllium Copper are non-sparking and therefore are used in ordnance plants, oil refineries and other places where explosions may occur from sparks off steel tools. Tensile strength as high as 200,000 lbs. psi can be obtained with Beryllium Copper; hence, it is used for many applications where resistance to high loading and impact fatigue are important, such as airplane motor bushings. Most of the critical springs and diaphragms used in aviation, Navy and Signal Corps instruments are made of Beryllium Copper because of its reliability as a spring material.

We hope this has proved interesting and useful to you just as Wrigley's Spearmint Gum is proving useful to millions of people working everywhere for victory.

You can get complete information about these tools from the Beryllium Corporation, Reading, Pennsylvania.



Man has tried for ages to rediscover the art of hardening copper. Today this can be done by adding to copper a small percentage of beryllium.

Not only does it produce an alloy harder than tempered steel, but one that does not produce sparks, an essential when working near highly combustible materials.

X-64

Me 323 Transport Plane Has Cabins in the Wing

A communique issued by the British Air Ministry gives particulars of the Messerschmitt Me 323 transport plane additional to those previously available. The communique states that this high-wing six-engined transport has a span of 181 ft and a length of 93 ft 4 in. and was developed from the Me 321 glider. It has, in fact, almost an identical airframe. The engines are Gnome-Rhone 14N 14-cylinder, two-row, air-cooled radials of 965 hp at 13,200 ft and give a maximum speed of approximately 170 mph at sea level.

The normal crew consists of two pilots, a radio operator and two engineers. The pilots' cockpit is forward of the leading edge of the wing and is heavily armored. The radio operator's cabin is actually inside the main spar of the wing on the port side, and in the leading edge of the wing on each side of the fuselage there is a cabin from which the engineers control the three port and three starboard engines respectively. Up to eighteen 7.9 mm machine guns can be mounted in various position in the aircraft.

Access to the main loading space, which is 20 ft long, 9 ft wide and 11 ft high, is through the nose of the fuselage, which is divided to form two vertical doors 11 ft high. There is a second loading space aft. It is 19 ft long and 9 ft wide with access through doors in the side of the fuselage. It is stated that a truck of 3-ton load capacity, a light tank or as many as 100 troops can be carried. The undercarriage is composed of six rear main wheels and four small front wheels, housed in fairings along each side of the fuselage.

Cheapness of production is considered to be the **main feature** of design and construction, for the machine is built mainly of steel tubes and plywood with fabric covering.

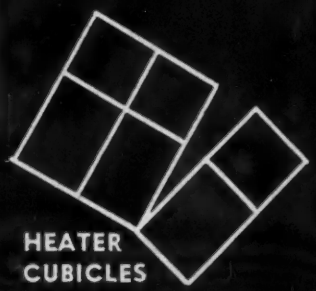
UPSETTING

MOTOR CONTROL

600 KW 400 VOLT
1920 CYCLE
MOTOR GENERATOR

GENERATOR CONTROL

UPSETTING MACHINE



HEATER CUBICLES

20,000 A DAY!

With line production "floating" on conveyors and high frequency heating for forging, 75 and 105 mm shells are put through this plant, from bar stock to packaged shells, at the rate of 20,000 per day.

Ajax-Northrup high frequency heating was chosen because of the short time cycle, small space required, low unit heating cost, freedom from scale and therefore longer life of the dies and less down time for changing tools.

The layout shown above with three heater cubicles, for instance, heats one 105 mm billet every 40 seconds. Five heaters turn out one 75 mm shell every 23 seconds using a 400 kw generator.

Time of heating is automatic. On account of the small heat loss, operators experience little or no discomfort, and the synchronous motors that operate the high frequency generator are of material value in improving the power factor of the entire plant.

The use of Ajax-Northrup equipment for both heating and melting has increased greatly during the past five years. A wealth of experience dating back to the first applications of high frequency in this country is available for priority applications and to a limited extent, for after-the-war planning.

60

and later on-

Practically all of the equipment in this installation will be readily convertible to automobile forgings, as small as 1" in diameter, when the emergency is over.

It will be possible to heat any section of the bar by changing the taps on the heater.

In fact, about 80 per cent of all investments now being made in Ajax heating or melting furnaces can be converted to produce new economies in peace-time efforts.

AJAX HIGH FREQUENCY FURNACES

NORTHRUP AJAX ELECTROTHERMIC CORPORATION, AJAX PARK, TRENTON, N.J.

ASSOCIATE COMPANIES: THE AJAX METAL CO. *Non-Ferrous Ingot Metal for foundry use.*
AJAX ELECTRIC FURNACE CORPORATION. *Ajax-Wyatt Induction Furnaces for melting.*
AJAX ELECTRIC CO., INC. *Ajax-Hultgren Salt Bath Furnace and Resistance Type Electric Furnaces.*
AJAX ENGINEERING CORPORATION. *Aluminum Melting Furnaces.*

New Production Equipment

(*Continued from page* 43)

Like all Vard roll thread snap gages, this new one is a combined "Go" and "No Go" inspection instrument for rapidly checking male threads to both maximum and minimum limits in one operation. It checks such critical conditions in the thread as pitch diameter, thread angle and lead.

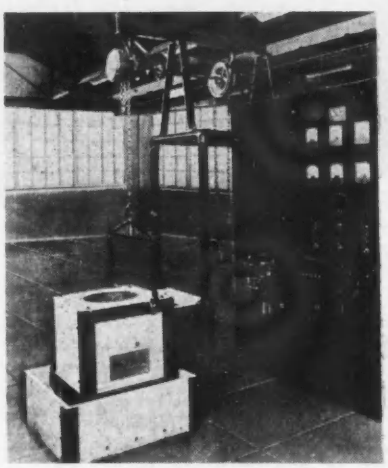
The roll thread snap gage does the work of two ring gages. In addition, it reveals specific inaccuracies so that steps can be taken to correct the tool or machine at fault.

Vard John-Sons roll thread snap gage is offered in sizes ranging from numbered series up to and including 12 in. and may be obtained in National, Metric, Acme, Whitworth and other special thread forms.

Vard snap gage

Two hundred pounds of uniform, homogeneous brass can be melted and cast in 50 minutes with the No. 70 50-kw., cubicle-type Ajax-Northrup lift-coil induction furnace unit. Designed by Ajax Electrothermic Corporation, Trenton, N. J., for small brass foundries, the unit adapts the advantages of melting by induction to present-day small foundry pouring practice.

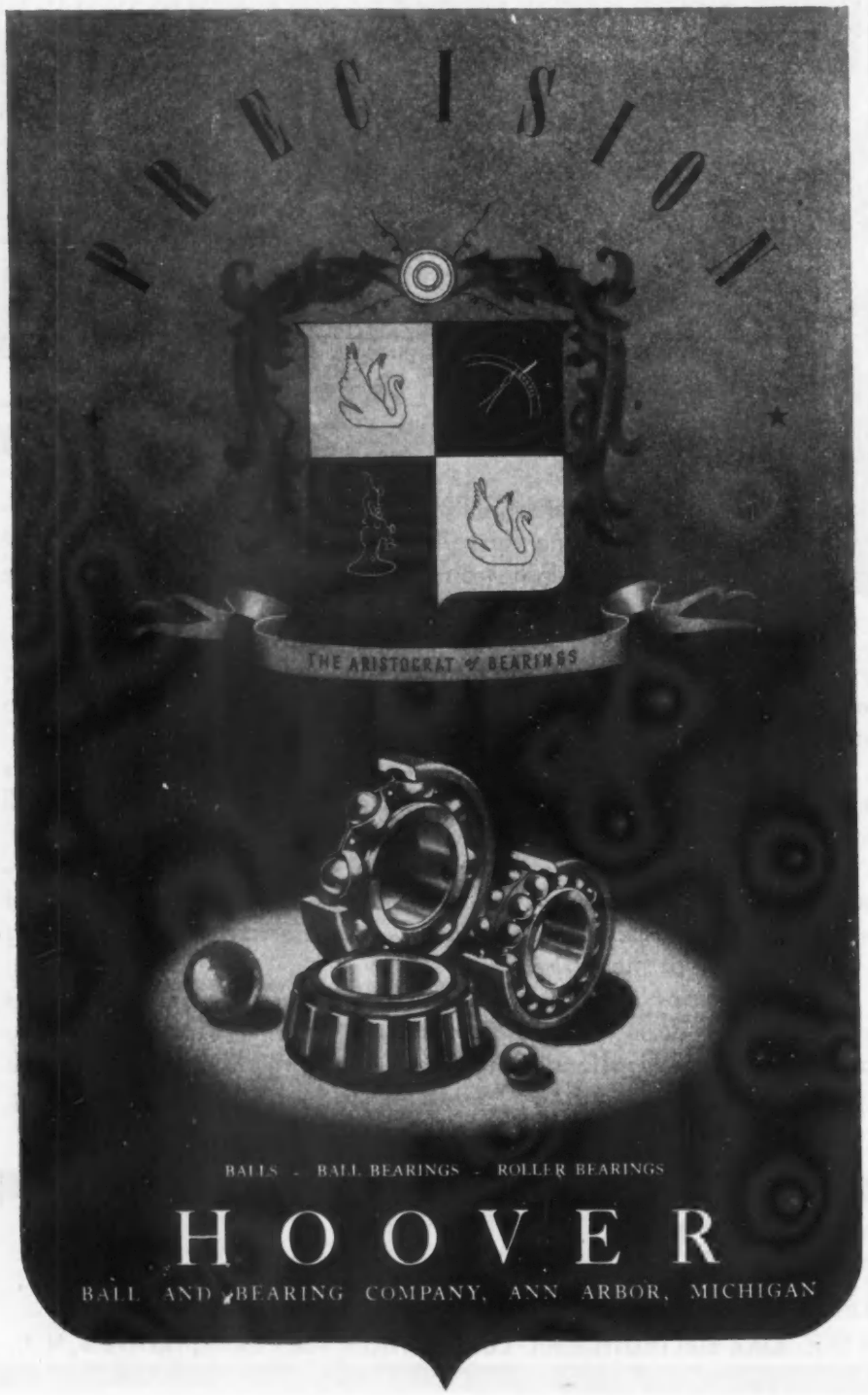
Controls are conveniently located, and the steel crucible houses all electrical control equipment. The unit is completely wired, the only connections necessary are for cooling water and for 3-phase, 60 cycle power supply. Uniform, homogeneous melts are said to be certain, as the electrical current induced in the charge stirs the metal thoroughly as it melts.



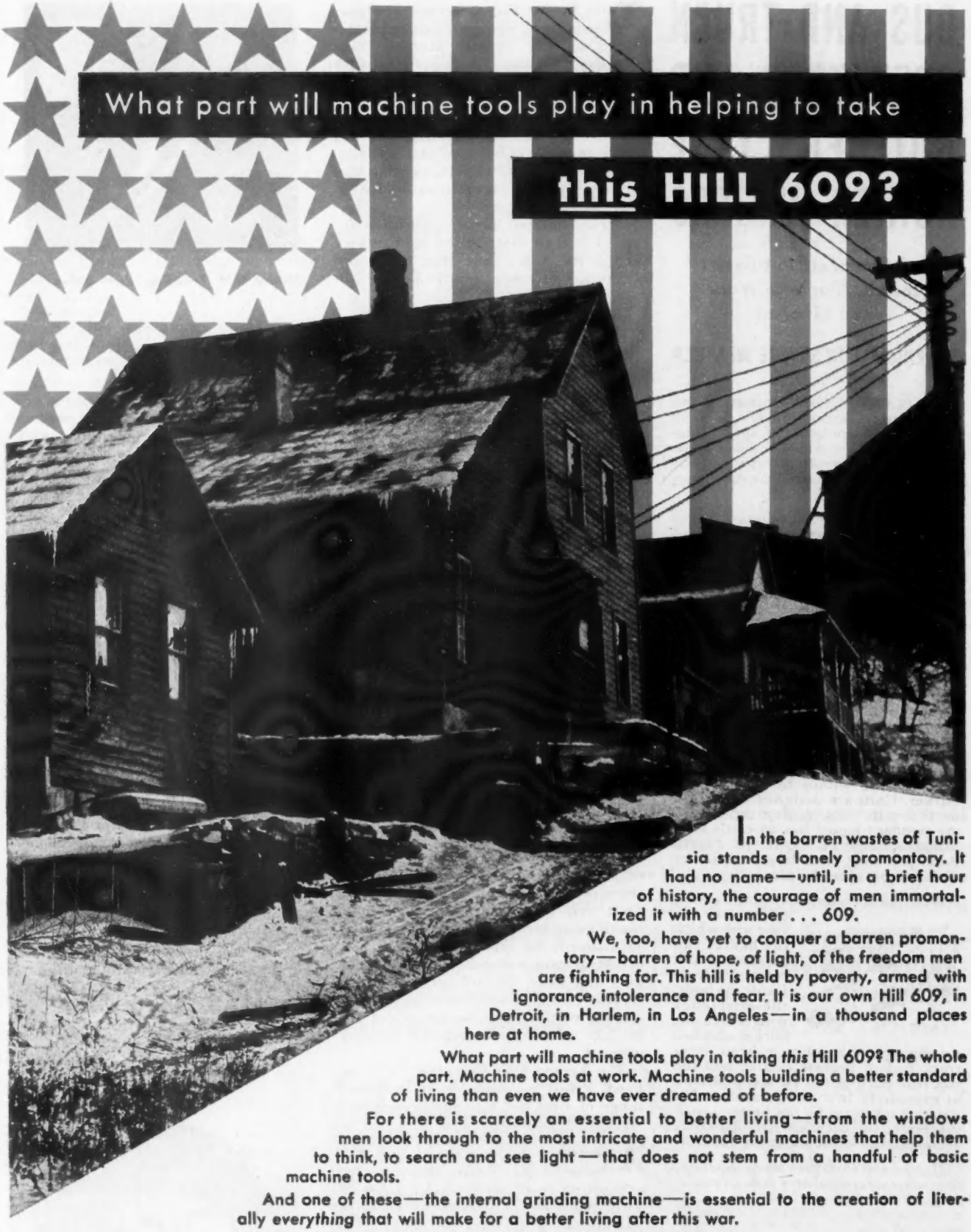
No. 70 Ajax-Northrup lift coil induction furnace unit

The crucible ordinarily is mounted on a rigid refractory safety base with a reclaiming receptacle for accidentally spilled metal. For continuous operation, two crucibles can be mounted on a small truck. While the charge in one is being melted, the other is being poured and recharged. A sand seal around the base of the lift coil prevents any chimney effect.

(*Turn to page* 80, *please*)


PRECISION
THE ARISTOCRAT of BEARINGS
BALLS - BALL BEARINGS - ROLLER BEARINGS
HOOVER
BALL AND BEARING COMPANY, ANN ARBOR, MICHIGAN

What part will machine tools play in helping to take this HILL 609?



In the barren wastes of Tunisia stands a lonely promontory. It had no name—until, in a brief hour of history, the courage of men immortalized it with a number . . . 609.

We, too, have yet to conquer a barren promontory—barren of hope, of light, of the freedom men are fighting for. This hill is held by poverty, armed with ignorance, intolerance and fear. It is our own Hill 609, in Detroit, in Harlem, in Los Angeles—in a thousand places here at home.

What part will machine tools play in taking *this* Hill 609? The whole part. Machine tools at work. Machine tools building a better standard of living than even we have ever dreamed of before.

For there is scarcely an essential to better living—from the windows men look through to the most intricate and wonderful machines that help them to think, to search and see light—that does not stem from a handful of basic machine tools.

And one of these—the internal grinding machine—is essential to the creation of literally *everything* that will make for a better living after this war.

BRYANT

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.

BUS AND TRUCK OPERATORS AND BUILDERS LIKE HUNTER HEATERS

Find Compact Unit Easy to Install, Simple to Work and Efficient

DEPENDABLE IN SEVERE WEATHER

CLEVELAND, OHIO—A heating unit that answers many prayers of both builders and operators of special mobile units for the armed services is the product of Hunter and Company of this city, makers of unusual gasoline heating equipment.

From the builder's standpoint, one of the most important features claimed for the Hunter Heater is its extreme compactness. One unit houses burner, blower and gasoline container. This assembly attaches to the outside of a truck, trailer or bus body, and in regular body production can be attached by two men within half an hour, without special tools.

Through two small openings in a front or rear panel of the body the heater re-circulates the air within by means of a blower. Units are designed for 24, 32 or 110 volts. The heating capacity of the standard model has an easily controllable range of 15,000 to 25,000 B.t.u. per hour, with larger capacities available on special order.

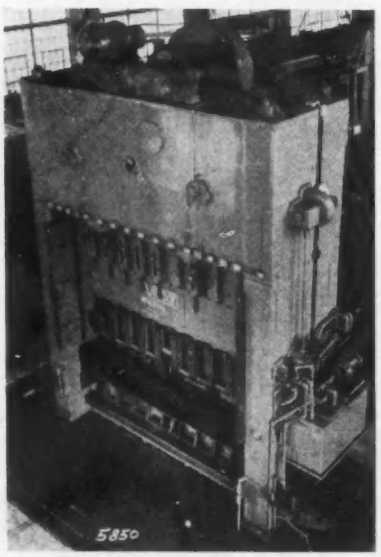
From the operator's viewpoint, strong points are the ease with which the heater can be started and controlled from inside the body, the efficiency with which the burner operates on any type of gasoline at hand, from truck fuel to highest octane, and the fact that starting can be accomplished at extremely low temperatures. No space is taken up by the heater inside the body, yet excellent circulation is accomplished throughout the interior.

Hunter and Company has announced that despite large orders now in manufacture, deliveries can be made on this heater in production quantities. Full information may be obtained by writing or wiring Hunter and Company, 1552 East 17th Street, Cleveland 14, Ohio.

(Advertisement)

THIS Verson Full Eccentric Transfer Feed Press, designed and manufactured by the Verson Allsteel Press Company, Chicago, Ill., is equipped with nine time stations. It can blank, draw, redraw, pierce, size, and emboss 720 filters per hr., untouched by human hand from start to finish. This machine has a capacity of 500 tons and is 138 in. between the housings. All working stations are interchangeable and individually adjustable.

Two points of force application insure an even distribution of pressure across the entire slide area. Slide and frame are of characteristic Verson All-steel welded contruction, which offers maximum resistance to torsional twist and deflection.



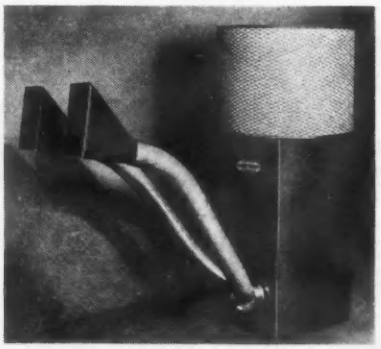
Verson full eccentric transfer feed press

Full eccentric construction provides maximum factor against shaft failure; there is no crankshaft to bend or break. Split cap design bronze-bushed main bearings permit easy renewal and quick adjustment. An extra long "full-thrust" eccentric strap reduces friction between gibs and slide. Barrel type adjusting screws, equipped with buttress threads, remain vertical at all positions of the stroke, virtually eliminating bending moment.

The Verson Full Eccentric Transfer Feed Press is available in a broad range of sizes and tonnage capacities.

A PORTABLE, self-contained dust collector of the cyclone-filter type for exhausting dust and dirt-laden air from most types of medium-heavy abrasive operations, is the newest addition to the line of Dustkop dust collectors made by Aget-Detroit Company, Ann Arbor, Mich.

The unit is entirely self-contained, having a multiple blade fan direct-driven by a 1/3 hp continuous duty motor, and a removable spun glass filter as well as the cyclone type separator. This combination allows the cleaned air to re-circulate into the working space for reductions in heating losses.



Model 950 Dustkop dust collector

Continuous duty operation of the new unit, known as Model 950, on medium heavy dust collection operations without frequent changing of the filter, is due to the cyclone separator which removes most of the dust and dirt before the cleaned air is returned to the working space through the spun glass filter material. The unit has a capacity of 490 cu ft per min with a single 5 in inlet.

A NEW Cincinnati No. 2 Releasing Box Tool is being manufactured by the Valley Tool & Supply Company, North Hollywood, Cal.

This tool is especially made for use on turret lathes and has a turning capacity of ¼ in. to 1 1/16 in. diameter, 3 in. long. A retracting tool mechanism draws the tool bit away from the turned stock leaving no mark. The retracting adjustment screw is made with a fine thread enabling the operator to set the tool down to the thousandth of an inch with the use of a screw driver. A lock nut locks the screw.

A rocker under the tool bit enables the operator to locate center quickly after regrinding the tool. Set screw behind the tool bit may be used for setting the tool at an angle while still having a support behind the tool. The roller

(*Turn to page* 144, *please*)

Cincinnati No. 2 Releasing Box Tool

High Degree of Flexibility

(*Continued from page* 24)

tain types of main bearings.

Also worthy of note are the Norton grinder set-ups for finish-grinding bushings and bearings of flanged types. Here they use a formed grinding wheel and with plunge-cut grind the OD, form an undercut, and face the flange. Needless to say, this requires an accurately formed wheel with diamond dressing to gage at regularly established intervals.

Perhaps the largest equipment in the plant is the battery of 2⅝ in. Conomatics, used for producing aircraft bushings from large bar stock.

To supplement this high-spotting, we reproduce below a condensation of the factory routings of an aircraft main bearing and a flanged bushing. These routings should provide a clear picture of just how the job is done. It may be noted that the use of repeated settings on similar machines or a shifting of the operation to a South Bend lathe has been developed deliberately to sub-divide each step in the interest of producing better quality. Air chucking is employed on all machines.

By contrast with the complexity of machining of aircraft bearings, the operational stages in the thin-wall automotive bearing department are relatively simple. As mentioned earlier, the coated strip is received in coils from the strip mill and is processed through a series of Bliss Press operations. All strip is first cut into blanks. On standard precision-type bearings, the blank is formed to size and is ready for machining. On large runs this is done in an automatic set-up with magazine feed for the blanks. Flanged bearings require several additional operations. Here the strip is formed and flanged in one setting, the blank being heated electrically before forming. Following this the flanged blanks are squared to size in a large Bliss press. Subsequent steps are standard and quite routine and are about as follows:

Chamfer edges
Shave the parting line in a small vertical broach
Cut oil grooves and drill
Plate steel back
Broach bore to size and finish
Burr—by hand
Inspect

Casting Department

This is the very heart of the aircraft bearing process, and is very much like a specialized foundry operation, employing entirely different techniques for different types of bearings. For the general run of aircraft bearings the shell is rough-machined in accordance with the casting procedure. Usually one end of the shell is fitted with a steel disk, crimped over in a machined groove, then welded tight. The

HEATERS FOR TRUCKS, BUSSES
TRAILERS, COACHES OF ALL TYPES

are compactly designed with burner, blower and fuel supply in one easily handled unit, that attaches outside body, recirculates air within through two small openings in a front or rear panel . . . On assembly line, complete unit can be attached by two men in thirty minutes . . . Burns any type of gasoline . . . Can be started and controlled from inside of body...Delivers up to 25,000 B.t.u. per hour . . . Blower, designed for 24, 32 or 110 volts.

BULLETIN HB-3 ON REQUEST

HUNTER AND COMPANY
Aircraft Equipment
1552 E. 17th St.
CLEVELAND • OHIO

open end is fitted with suitable cores which are prepared in advance and baked in two operations—low temperature bake to remove moisture, then a high temperature bake.

Before casting, the shells are chemically cleaned to assure a perfect bond by washing in one of a number of Blakeslee vapor degreasers. The cores now are assembled and the lower end is fitted into a Chromite cup. The entire assembly then goes to furnaces for heating to the proper temperature. Meanwhile the copper-lead alloy has been melted in a battery of melting furnaces and delivered in small ladles to Ajax induction heating furnaces where the metal is heated to higher temperature and refined. At this stage, the heated molds are removed from the furnace, brought over to the Ajax furnace where the metal is poured into the cavity.

Immediately following this pouring operation, the molds are removed and dropped into a water-quench to freeze the bearing lining. After cooling the molds go to the cleaning room. Here the cores are knocked out, the end plugs are cut off on A. C. Campbell abrasive cut-off machines, the cores cleaned out by boring, and the bearing shells sand-blasted in a battery of Wheelabrator Tumblast units. All bearings with 80-10-10 linings are annealed before machining by treatment in Lindberg pit-type drawing furnaces.

It is of interest to note that the aircraft bearings are inspected for perfection of copper-lead lining structure by X-ray examination. To reduce rejections and to maintain a high level of quality in the foundry operation, a sampling inspection by X-ray is made on rough bearing shells before they leave the foundry. For this purpose, the samples are collected, then rough machined and bored to expose the bearing lining. These are then X-rayed and analyzed before releasing the production batch.

Foundry procedure is quite different for extremely large bearings produced in smaller quantities. Here the shells are suitably rough-machined to provide excess stock with recess for a steel disk at each end. One end is sealed with a disk, crimped over and welded tight. Then a measured weight of prepared bearing alloy shot is dropped into the shell, and the other end is sealed. The shells now are heated to a high temperature in large rotary hearth furnaces, bringing the entire unit to uniform temperature and melting the shot. Upon removal from the furnace the shell is chucked in a lathe and spun at a predetermined speed so that the bearing metal is uniformly distributed by centrifugal force. Simultaneously, the shell is chilled by a nozzle spray of cold water to freeze the layer of bearing metal.

One section of the casting department is set up for silver plating operations. Here the shells or washers are degreased, pickled, then receive a nickel strike for bonding. Silver plate is deposited one area at a time, using cast silver electrodes in vertical baths for the bore, and in still baths as a separate operation for outside surfaces. In each instance the work is completely masked save for the surfaces to be plated. All silver lined bearings are annealed at low temperature.

Strip Mill

The strip mill is divided into two distinct departments—one for copper-lead alloy, the other for white metal. Consider the copper-lead department first. Strip is received in coils wide enough to provide material for a flange on each edge. The purpose of this is to have a channel-shaped tray for the alloy. The coil enters a long, automatically-operated mill, in which the first station has rolls for forming the channel. The next station is a resistance heating unit to bring up the temperature of the strip prior to entering the next stage which is a heating furnace which controlled atmosphere. Upon emerging from the furnace, the strip enters the pouring station which is fed from the melting furnaces. The strip then goes through a cooling chute.

Although all copper-lead coated strip is processed in this fashion, the final stage depends upon the type of alloy.

MANY *times Longer Life* than Hard Steel Gage Blocks

You can now reduce the cost of maintaining your sets of gage blocks by specifying the use of Dearborn Chromium Plated Standards. Their longer wearing qualities makes them ideal for use on production checking operations. Let us prove to you how industry is reducing gage costs through the use of Dearborn Standards.

Reasonably Prompt Deliveries

DEARBORN GAGE COMPANY

Originators of Chromium Plated Gage Blocks

22037 BEECH STREET • • • DEARBORN, MICH.

HE'S FIGHTING FOR US . . .
WE'RE WORKING FOR HIM

The war has changed many old fashioned ideas. Every soldier at the front now knows that the men and women on the production lines are part of the team working as well as fighting for Victory. Making arms is as necessary as shouldering arms. And, there's many a soldier of the Allied Armies who is living today because American-made products far exceeded in quality, in durability, in performance, the best that our enemies could produce. There've been hundreds of examples, how American shells pierce the enemies heaviest armor. How "dud" bombs and grenades made in Axis plants failed to explode.

When these boys come home again they're not going to be interested in "cheaply" made merchandise. They'll want the best—right up to "Service" standards. So in your plans for postwar products—don't sell America short on quality—improve the product, don't cheapen it to a price. If you concur in this idea of postwar buying—we'll be glad to discuss precision stamping, finishing and assembling with you. But not now—we're busy on war work.

P. O. No. 824-22

THE BELLEVUE MANUFACTURING COMPANY

Precision Made Stampings

BELLEVUE, OHIO

One type of alloy is of such character that it must be cut into long straight strips. These are laid absolutely flat and handled flat right up to the blanking operation.

The general run of coated strip, however, is coiled as it comes out of the cooling chute and is handled in coils in the press shop. Some of these coils, depending upon analysis, are annealed in Westinghouse annealing furnaces.

Channel section strip requires several machining operations in the mill before going to the machine shop. First, the flanges are milled off in a special unit, then the strip is milled to proper thickness in another mill. The coils or long strip now are ready for transportation to the press shop.

The white metal department has four long automatic lines. In preparation for the strip mills, coils of strip steel are processed through a Taylor-Winfield butt welder to join the strip into continuous lengths. The strip then moves through an anodic cleaning station, a cold water rinse, chemical etch, cold water rinse, then into the tinning bath. At the entrance to the bath, a stream of hydrochloric acid gas is impinged on the strip to serve as a fluxing medium. At the exit end of the tinning bath, excess tin is wiped off by a rubber brush.

The next station is the babbitt melting furnace with a holding pot for pouring. At this point, before the strip enters the babbitting station, the tinned surface is again treated with the HCL gas. Upon leaving the babbitting station, the strip is cooled to freeze the alloy. Next follow two machining operations—milling of the steel back to exact thickness, and skiving off a thin strip of excess babbitt (about 0.005 in. thick). As the strip leaves the milling stations it is coiled, then the coils are annealed in box-type furnaces ready for the machine shop.

We mentioned earlier that the company also produces Tri-Metal bearings in which a layer of babbitt is deposited on copper-lead. To produce such strips requires, first, the processing in the copper-lead department, then a separate processing in the white metal department, thus accounting for the difference in cost between bearings of these several types.

The foregoing is necessarily a general treatment of this highly technical manufacturing operation. However, even such treatment when supplemented by the pictorial section should provide the reader with a rather comprehensive perspective of how aircraft and automotive type bearings are made. And, we hope, a better appreciation of the problems that confront the manufacturer.

By the Army, the Marines and the Navy too.

This 11-inch ball-bearing SHELDON Precision Lathe has been selected by the Army for its Mobile Machine-shop Units, by the Marine Corps for its trailerized shops and as the ideal maintenance lathe for several types of shops by the Navy.

This lathe and bench unit comes with a SHELDON E-type, 4-speed Underneath Motor Drive, a Draw-in Collet Attachment (1″ collet capacity), a Telescopic Taper Attachment, Full Quick Change Gears and a Double-wall Apron with Power Cross Feed. The steel Bench completely houses the underneath motor drive in its left pedestal and provides 5 fitted drawers for tool attachments, etc.

SHELDON

SHELDON MACHINE COMPANY, INC.

4220 N. Knox Ave. Chicago 21, U.S.A.

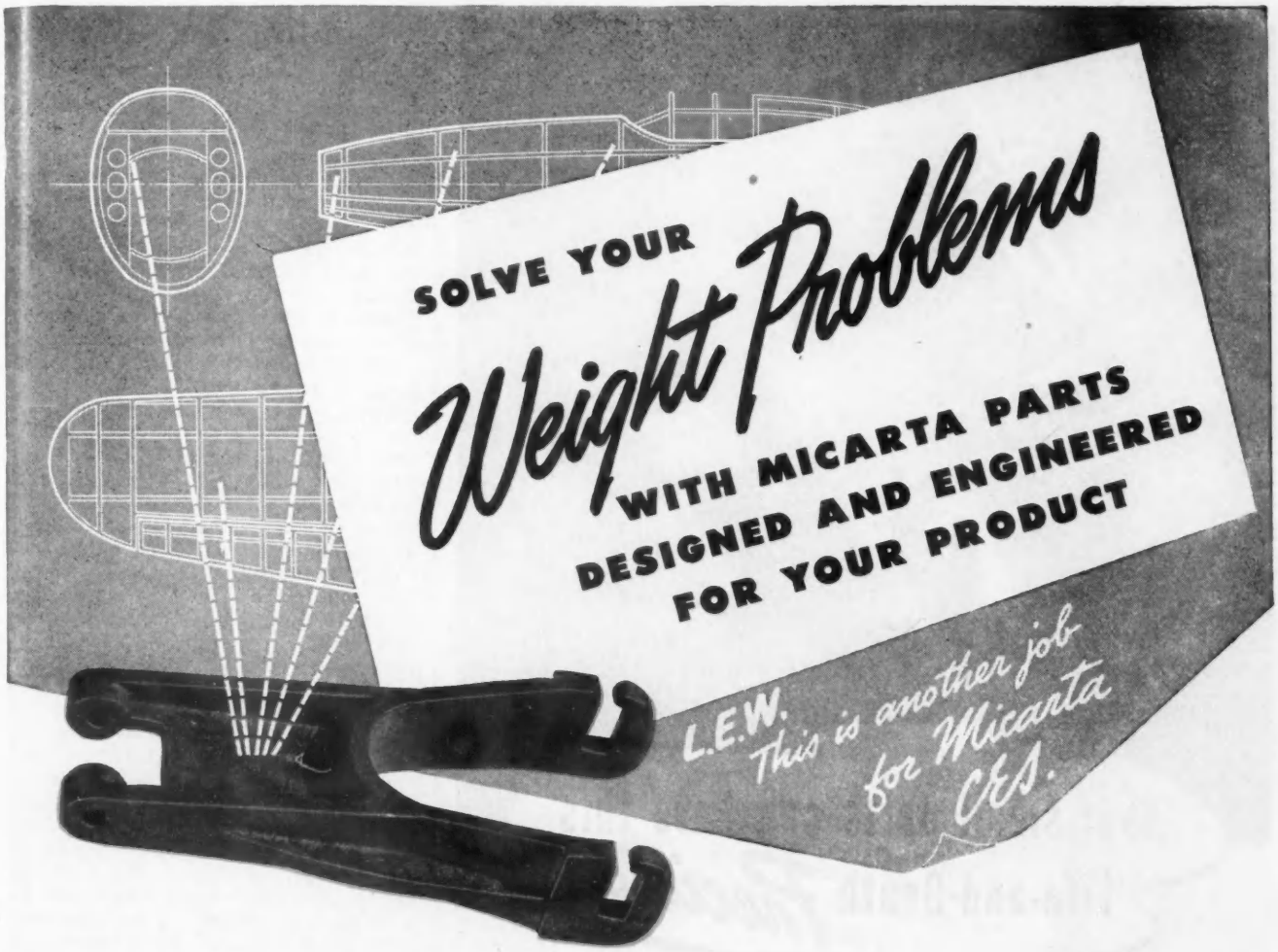
Information Exchange Helps Aero Industry

The West Coast aircraft industry has shared precious engineering information on production short-cuts on more than 8,266 occasions. Peacetime equivalent of this knowledge-pooling program would be for competitors to have ready access to each other's trade secrets. These information exchanges were a contributing factor in bringing the nation's production to the 100,000 planes-a-year rate.

Officials of the Aircraft War Production Council said an incalculable number of production-line manhours have been saved by these exchanges. The savings in engineering manhours, which are the key, crucial manhours in munition manufacture, to December 1, 1943, numbered 765,979, the Council reported.

As the coordinating agency for the seven major Pacific Coast warplane companies—Boeing, Consolidated Vultee, Douglas, Lockheed, Northrop, North American and Ryan—the Council serves as the pooling point and clearing house for such improved production methods and engineering short-cuts.

These short-cuts are shared, not only among the member companies, but the entire aviation industry and non-aviation war plants generally, wherever they can be applied to speed munitions output.



If your present manufacturing operations or postwar plans involve product parts where light weight is essential, consult Westinghouse.

Skilled Micarta engineers will be glad to study your product and to analyze its applications. And they will give you the benefit of 35 years' experience with industrial plastics.

This experience is particularly extensive with respect to aircraft applications . . . for example,

MICARTA IS THE IDEAL MATERIAL for airplane fairleads, guides and pulleys. Its weight is only one-half that of aluminum.

ON FIGHTERS AND BOMBERS, literally millions of Micarta parts are in constant use. Micarta is also used for control and instrument panels, antenna masts, terminal blocks, spacers and bearings . . .

AND IN MANY OTHER INDUSTRIES . . . hundreds of thousands of Micarta products are in use where light weight and dependability are vital.

In the majority of these applications Micarta is used as a replacement for critical materials and is serving better.

We urge you to find out the facts about Micarta today. Wire or phone your nearest Westinghouse office or write to Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa., and ask for a copy of the new Micarta Data Book—B-3184. J-06339

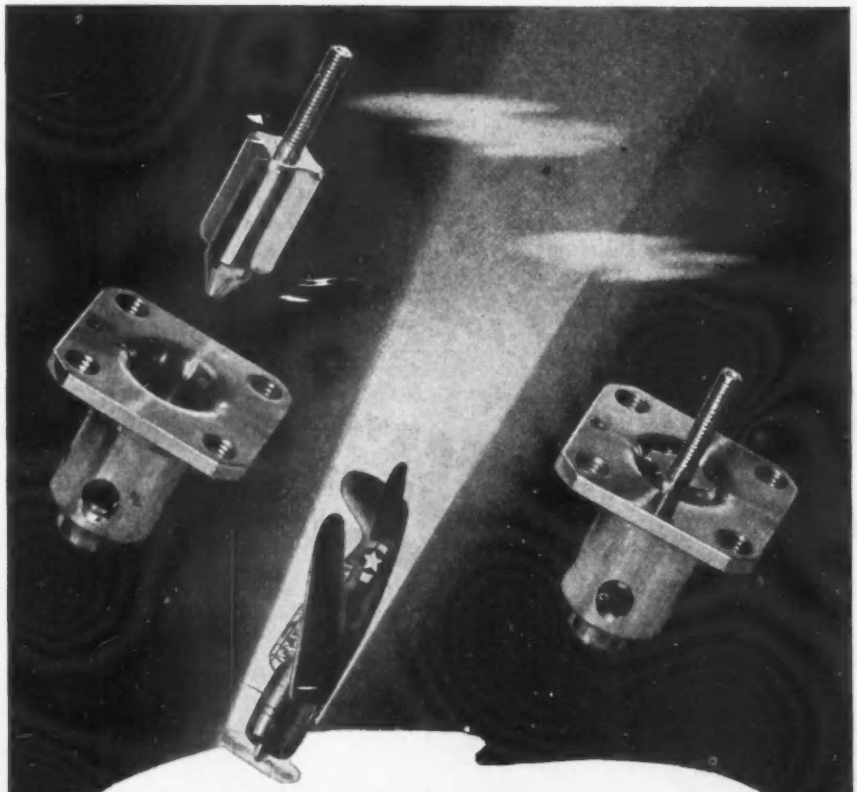
TYPICAL MICARTA TOUGH JOBS IN WAR APPLICATIONS

Aircraft structural parts	Protective helmet liners
Industrial gears	Aircraft control pulleys
Instrument panels	Bus supports
Steel mill bearings	Fuse mountings
Thrust washers	Insulating washers
Marine bearings	

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Micarta *The* INDUSTRIAL PLASTIC



Your small parts can have this Life-and-Death *Precision*

. . . Western Automatic offers you the skill and facilities that now produce in war quantities aircraft precision parts like these

DEVELOPED in peace-time, Western Automatic's production ingenuity, skill and vast facilities are able to meet the tremendous demands of precision work for war — will be able to serve your post-war needs with unusual satisfaction. The two small vital components illustrated above are made of stainless steel to exact tolerances that assure freedom of action and so finely finished as to guarantee against corrosion by the fluids to which they are subjected. One important fact for you is that manufacturing controls and step-by-step inspections make complex precision work like this possible on a quantity basis. This service is yours tomorrow — we're busy today but we might be able to help you now — better write us.

Aircraft Products Division

Western Automatic

Machine Screw Company

Elyria, Ohio, U. S. A.

Precision Parts and Assemblies Since 1873

Welding Jig Clamp

(*Continued from Page* 33)

12 are drilled with a simple drill jig after all welding on the base is done. They are drilled 1/32 in. oversize, and not quite through the bottom member, to form a stop for the pin. The ⅝-in. bolt (9) passes completely through the base, as shown, and the head is welded on one edge only, so that it may be knocked out and replaced. The photographs do not show this feature, as they were taken before it was introduced.

Views A and B in Fig. 5 show the complete clamp bolted to the slot bar. View C shows how the movable jaw may be removed from the base by slipping it to the left, dropping the end down and sliding it off to the right, while view D shows the parts and hardware for making the clamp. All parts are standard bar size. Though all of the photographs show the 2-in. capacity, clamps can be made for capacities up to 12 in. opening, or more, by merely increasing the length of A, part 5, and B, part 1. All parts except these are the same for clamps of all capacities, and the same welding jigs are used in their construction.

Where parts must be held too close together to permit space for the clamp, the wide-opening jaw is used, and spacer blocks are placed between the parts. It is not necessary to have a complete set of clamps for each capacity. The long base, B, Fig. 4, may be used with any length of movable jaw, A, up to the capacity of the base.

As it was feared that driving the wedge would knock the clamp out of alinement, the first clamps were made with two bolts to slip through the slot bar. This did not permit the clamp to be placed at an angle to the bar. A series of tests was made with the clamp held by the ⅝-in. U. S. S. bolt. The nut was pulled up by one hand to normal tightness, and it was found that, with the 12-deg. wedge, any number of hammer blows of weight more than sufficient to tighten the clamp would not move it out of alinement. Of course, two clamps are generally necessary to hold each piece of work in alinement. The normal procedure is to place the work in the two clamps, push up the wedge in the first one, drive the wedge in the second with one light blow, then drive the wedge in the first. Thus any tendency for the clamp to rotate is offset by the width of the jaw against the work.

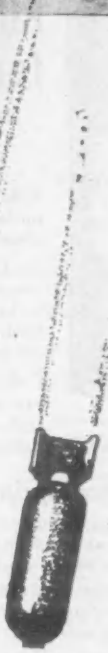
Uses of the universal clamp are not limited to flat work on the tilting table. It may be bolted to uprights or overhead bars to hold vertical work, or used to hold pieces together so that they may be turned to any welding position on the table. Experience with many devices for holding work, and study and experimentation from all angles, has convinced Mr. Freeman that the universal welding jig clamp is a solution of a very large part of the problem of alining and holding parts to be welded.

Enforcing the Law of Retribution

By dominant air power the enemy expected to bomb the world into submission. Ironically, their downfall is now assured by even greater Allied air power. Their master minds failed to take into consideration the incomparable ability of American labor and industry to coordinate for mass quality production.

Today American planes, such as the Liberator long range heavy bomber, are relentlessly wrecking the vitals of Nazi Germany, and Japan's turn is close at hand. Overwhelming in numbers, American planes are superior to enemy aircraft in every respect, including their ability to get back to bases after heavy flak and shell fire.

We are happy to be able to contribute something to the long range and ruggedness of these planes by furnishing large quantities of super-tough drop forgings for the plane parts which must withstand the terrific stresses of long hours of flight and strenuous combat. Our modern plant is devoted exclusively to the mass production of quality airframe drop forgings.



Member of the A.C.C.A.

Kropp Forge Aviation Co.

5301 W. ROOSEVELT ROAD CHICAGO

Engineering Representatives in Principal Cities

New Products for Aircraft

(*Continued from page* 41)

ance rarely achieved in hand splices the production of which varies with the experience of the splicer. They permit the application of loading stresses in a line that is parallel to and coincident with the axis of the cable. This avoids all possibility of unequal stresses upon the wires of the cable such as might be imposed at the cable end of the fitting if it were not a true center pull. Complete control assemblies of Tru-Loc Center Pull Loop Fittings are available in cable sizes 3/32 in., ⅛ in. and 5/32 in.

Bendix Recognition Light Switch

The Model LS-15 recognition light switch, manufactured by Bendix Aviation, Ltd., North Hollywood, Cal., furnishes control over the outside lighting system of an airplane for purposes of identification and recognition. A toggle switch furnishes separate control over each of four lights—white, red, green, or amber. By varying the pattern of the light according to the three positions possible for each switch—"steady," "off," and "key"—it is possible to work out 81 distinct combinations. This number can be extended to an almost unlimited degree by using different keying patterns.

The box and cover are fabricated of drawn aluminum alloy and painted to specification.

The toggle switches are of the luminous type. The Army-Navy approved keying switch is capable of controlling circuits of over 140 watts.

The customer may drill a hole (or holes) in the box for the connecting wires at whatever point is best suited to the installation. Five wires with terminal lugs are required, but not supplied by the manufacturer. Four mounting holes are provided in the back of the box.

Brushes for Aircraft Electrical Equipment

A development of interest to the aircraft industry is covered in a recent announcement made by National Carbon Company, Inc., Cleveland, Ohio. The company states that for the past two years its research laboratories have been extensively studying the difficulties associated with the operation of brushes at high altitudes on aircraft electrical equipment, coordinating laboratory tests with results obtained in actual high altitude flight. As a result of this study the cause of previous brush failure at high altitudes has been determined, resulting in the development of a series of brush grades affording a range of operating characteristics sufficiently broad to cover practically every type of rotating electrical equipment used on aircraft and designed to give satisfactory performance, not only under the conditions met at high altitudes, but also at sea level and under conditions of very high humidity. This development is significant because it affords protection of aircraft electrical equipment throughout the entire range of flight and under the most adverse conditions.

In announcing this development the company states that these new brush grades have in their composition itself, accurately determined amounts of special materials which maintain a protective film on commutators and assure satisfactory brush life under all service conditions. Laboratory tests are said to have shown that these new ingredients in the brush composition are capable of maintaining a protective surface film on commutators and slip rings in dry nitrogen and at atmospheric pressure as low as two millimeters of mercury.

While these new grades were primarily developed for operation under conditions of low temperatures, low humidity and rarified atmosphere, they have also shown performance at sea level and under conditions of high humidity comparable to that of corresponding grades not designed for high altitude operation.

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FUSE every instrument for SAFETY with . . .
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This is a war of electrical instruments—for metering, testing, inspection, protection—absolutely necessary to production.
Such equipment must work dependably and constantly. High speed production has brought about an acute problem. These instruments are in danger of overwork. Many are irreplaceable.
Critical materials used in their construction are required for a multitude of other essential purposes. Jewels used in instruments are difficult to obtain.
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Present Equipment Must Be Kept on the Job!
Efficient fusing prevents damage by short circuits—burnouts—saves valuable instruments—protects them from inexperienced operators.
So important is fusing that many plants and laboratories are making complete surveys of their equipment, and installing new fuses throughout.
Littelfuse will be glad to help you with practicable suggestions on fusing instruments and other equipment. Feel free to call on us.
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IS THERE AN ENGINEER IN THE HOUSE

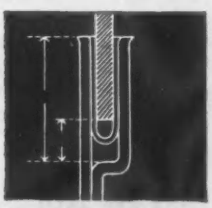
who has not received the key facts on mounting

Aero-Quality LUMARITH?

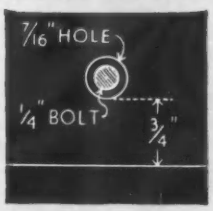
Reg. U. S. Pat. Off.

To get the value of Lumarith's extreme toughness, flexibility, impact strength and self-distribution of stresses (the kind of toughness which prevents cracking and shattering under high stresses) it has to be mounted correctly. . . . So watch these 4 points in mounting specifications for Aero-Quality Lumarith and you can count on the toughness of Lumarith transparent sheets to meet the strain of your design.

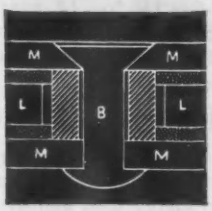
1. GAUGE—Use a sheet heavy enough to do the job. For most applications, engineers specify .125" nominal thickness.



2. CHANNEL DEPTH—Assume the airplane window will be exposed to temperatures from –70° F. to 140° F. and humidities from 0% to 100%, then make full allowance for expansion and contraction by proper choice of channel depth and sheet size. (See Lumarith Mounting Book, 2nd Edition for formula.)



3. BOLT HOLES—Don't spoil your mounting with tight bolt holes. Before specifying size of bolt holes, distance from the edge and the spacing, see results of tests, given in Lumarith Mounting Book, 2nd Edition. (These tests cover various combinations of the three factors.)



4. SPACERS—Be sure the spacers are big enough to prevent the metal plates "grabbing" the Lumarith sheet when the bolts are tightened down. You should just be able to move the Lumarith sheets in the channel after the bolts are tight.

Watch these 4 points and you get the full value of Lumarith's toughness, flexibility, high impact strength and self-distribution of stresses. Of course, you'll want a personal copy of the new 2nd Edition of the Lumarith Mounting Book. Let us know where to send it. Regulations require that we ask you to write on your business letterhead. CELANESE CELLULOID CORPORATION, *The First Name in Plastics*, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16●

Union Membership Maintenance To Be Opposed in New Contracts

(*Continued from page* 48)

union and management representatives. If the member makes no claim that is subject to arbitration under the maintenance provision and he is found to be delinquent, the union may request his suspension from his job for not to exceed 30 days. If at the end of that time he has failed to restore himself to good standing, the union may request his discharge. Before a maintenance of membership clause goes into effect, all employes are given 15 days in which they can decide whether to remain and become union members or not.

Dissenting industry members of the Detroit Regional WLB recently offered an alternative to a maintenance of membership clause in a case involving the UAW-CIO and the Ex-Cell-O Corp. The union asked for some form of security as a result of the large labor turnover at the plant and the consequent shifting in membership and leadership. The industry members proposed as an alternative either an election among employes to determine if they wanted maintenance of membership or a compulsory checkoff to be coupled with the maintenance clause. Labor and public members voted down both proposals, including the checkoff.

In answer to the demand of the UAW-CIO that Chrysler Corp. break the Little Steel formula and grant an overall wage increase as a cost of living adjustment in excess of the allowable 15 per cent and additional adjustments to meet special costs and needs, R. W. Conder, Chrysler director of labor relations, pointed out that the earnings of Chrysler employes have risen 53 per cent on the average since Dec. 15, 1940, while living costs have risen less than 25 per cent. In addition, the National WLB has ordered for Chrysler employes during this period special benefits amounting to $3,700,000. Conder asserted that employes' actual earnings are enough above the increased cost of living to pay their war taxes and still leave them better off than they were before Dec. 15, 1940. Conder also pointed out that the union is in the process of negotiating at the present time a number of other far-reaching demands for wage increases, or having that effect. He termed the new demands as inflationary in effect and contrary to the government's stabilizing policy.

A variation of the post-war security fund for employes was denied recently by the Detroit Regional WLB. Continental Motors Corp. and the UAW-CIO submitted a plan whereby 5 cents an hour would accrue on the company's books for all hours worked over 56 hours per week by all employes of the company between Dec. 1, 1942, and April 1, 1944. An additional 5 cents per hour would accrue on the same basis from April 1, 1943, to April 1, 1944. The funds would be paid after the war in such form as the National WLB might deem proper. The plan was refused because in effect it amounted to a wage increase of 10 cents an hour for overtime work and therefore did not conform to the Wage Stabilization Act.

The National WLB recently upheld the Detroit board in denying pay to employes of the propeller plant of Nash-Kelvinator Corp. who engaged in a two-day work stoppage in November, 1942. The UAW-CIO charged that the company had locked out the workers after a dispute involving two supervisory employes.

Seventeen hundred employes of the Essex Wire Co., Detroit, have been granted 3 to 5-cent bonuses for afternoon and night shifts and a 75-cent minimum starting wage by the WLB. This plant was plagued by three wildcat strikes last summer as a result of the dispute over wage rates and a jurisdictional row between an independent union, which holds bargaining rights, and the UAW-CIO. Employes voted to strike, 992 to 306, in a poll under the Smith-Connally Act last October, followed by a five-day strike which threatened production at the Ford Willow Run bomber plant which Essex supplies with wiring assemblies.

Sees Civilian Rubber Still Short This Year

Heavy demand for military tires and other rubber products indispensable to the armed forces may result in continuing shortages of many vital and essential rubber articles for civilian use during 1944, according to John L. Collyer, president of the B. F. Goodrich Company.

"The large war-born synthetic rubber manufacturing industry should achieve its rated annual capacity of approximately 800,000 tons by July of 1944," he said. "The 1944 consumption in the United States of synthetic rubber and crude rubber will probably closely approach the 1941 record consumption of 775,000 tons. Conversion of rubber product manufacture from natural to man-made rubber must be accomplished at an increasingly rapid rate or our supplies of crude rubber, still necessary in the manufacture of certain rubber products, will be exhausted.

"The nation's rubber stockpile at the close of 1943 had declined to approximately one-fourth of the Pearl Harbor level, while anticipated new imports of natural rubber during 1944 will amount to no more than 80,000 tons unless rubber-producing lands are recaptured from the Japanese, according to the most recent report from the Office of Rubber Director.

"The nation must now rely mainly upon synthetic rubber and there will be further reductions in the proportions of natural rubber used in most products in which crude rubber is still employed."

Obituary

Byron V. Covert

Byron V. Covert, 80, pioneer auto manufacturer, was found shot to death in his Lockport, N. Y., home Dec. 18. The coroner issued a certificate of suicide. In 1903 Mr. Covert founded the Covert Motor Vehicle Company and manufactured a small automobile, later giving up car building to concentrate on the manufacture of transmissions. With Alfred P. Sloan, he was one of the backers of the late Herbert C. Harrison in founding the Harrison Radiator Corp., now a division of General Motors. A son, Klare F. Covert, directs public relations for Harrison Radiator.

William G. Irwin

William G. Irwin, 77, nationally prominent industrialist, financier and philanthropist and one of the key figures in the development of this country's diesel engine industry, died suddenly on December 14 in Indianapolis. He was the founder of the Cummins Engine Co., Columbus, Ind.

His death occurred in his offices at the Indiana National Bank, of which he was president. The Cummins Engine Co. grew out of an association with Mr. Irwin of a young employee during World War I, named Clessie L. Cummins, a pioneer in diesel development and today president of the company.

Glen G. Holt, Sr.

Glen G. Holt, Sr., vice-president of the Perfex Corp., died at the age of 47 years on November 26. He was a native of Salt Lake City. Mr. Holt was widely known in the automotive field and was an authority on radiators. Before joining the Perfex Corporation in 1934 he was associated with the Lavine Gear Company for 16 years. He was an associate member of the Society of Automotive Engineers since 1937.

David B. Piersen

David B. Piersen, chairman of the board of directors of the Stephens-Adamson Mfg. Co., Aurora, Ill., died November 29 of a heart attack at the age of sixty-three. He started with the company when it was founded in 1900. He served as sales manager, secretary and vice-president, before being elected president in 1914. Since 1934 he had been active in sales and administration as chairman of the board.

Proven today in war, where it is in active use in military vehicles on all fronts, the Eaton Rotor Pump at the proper time will likewise be incorporated in many postwar applications. You are earnestly invited to make full use of Eaton facilities in your own engineering program.

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EATON ROTOR PUMP

Carrying the Army's load

ON SKF BEARINGS

U.S.A.
Tips
ON BEARING CARE
To make present equipment last longer
1. Use clean lubricant recommended by the manufacturer of this machine.
2. Avoid loads and speeds beyond those recommended by the manufacturer.
3. Check wiring and insulation frequently. Short circuits or stray currents can damage bearings.
4. If necessary to remove bearings, keep them properly lubricated. Avoid the intrusion of water and dirt. Apply pressure on the inner race only. Don't hammer outer race.

U. S. Army Signal Corps photo.

The biggest fleet owner in the world has one thing in common with the operator having only a truck or two: the application and maintenance of antifriction bearings. Manufacturers knowing full well the value of bearings, have turned the responsibility for many smooth-running truck shafts over to SKF's. And SKF's, built to align shafts properly, resist wear and never need adjustments, aren't letting them down. Where Victory depends upon Performance, SKF's are an outstanding part of the job. 5372

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SKF INDUSTRIES, INC., PHILA., PA.

Developed for Faster Maintenance

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SPEEDRIVER KIT

For rapid handling of screws and bolts, as well as burring drilled holes. Adapter permits use of the bits with power driven tools. Handle is rugged and full swiveling, with a positive fitting jaw for the bits. This convenient kit contains tips for Phillips, Reed Print and standard tip screws, socket tips, burring tip and adapter.

Aircraft TOOLS are a complete line of modern, rugged hand tools, that will be available for all industry as soon as their present war job of aircraft construction and maintenance is completed. Information on tools for post-war delivery will be sent to established distributors.

Industrial Division

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Aircraft TOOLS, INC.

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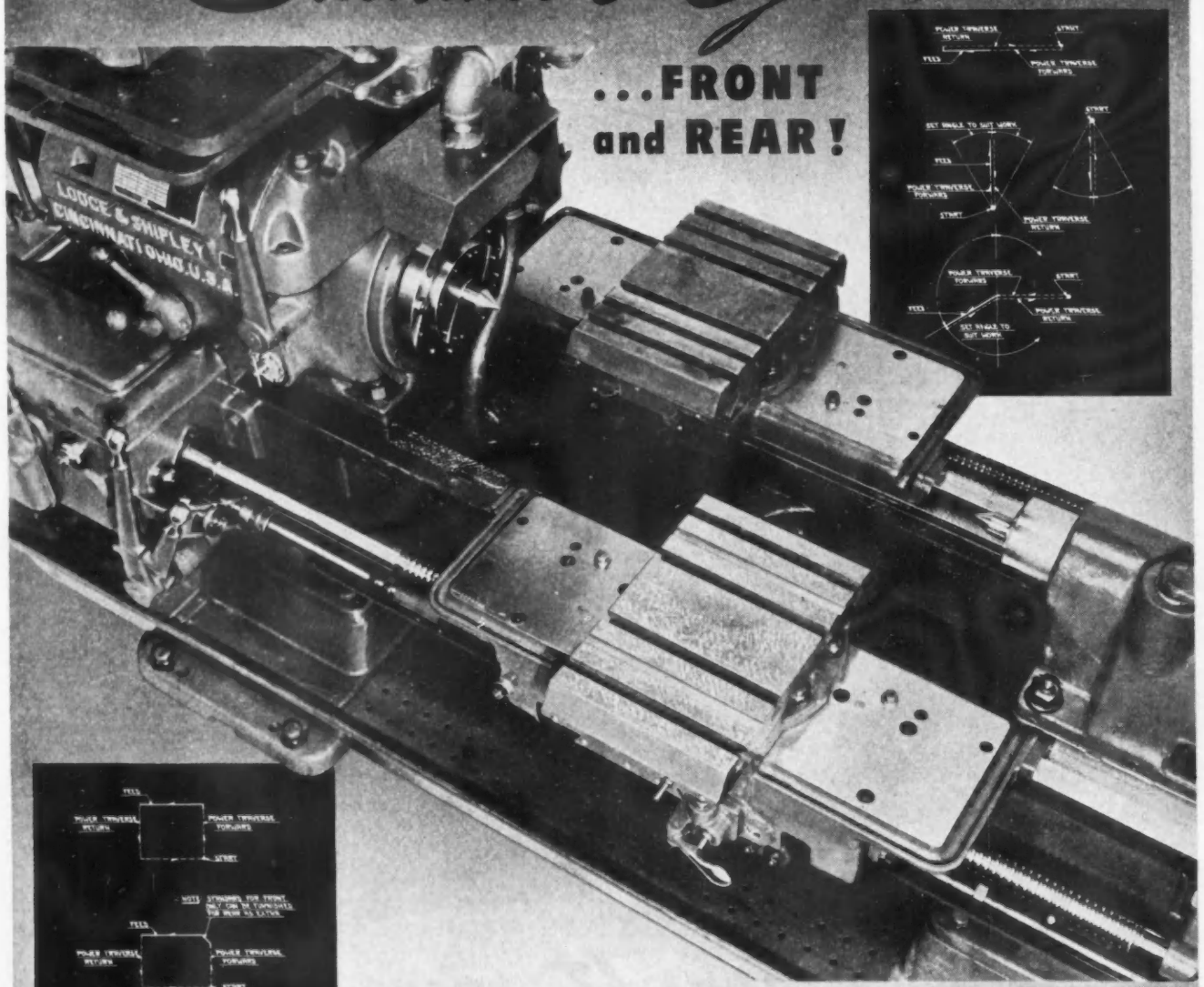
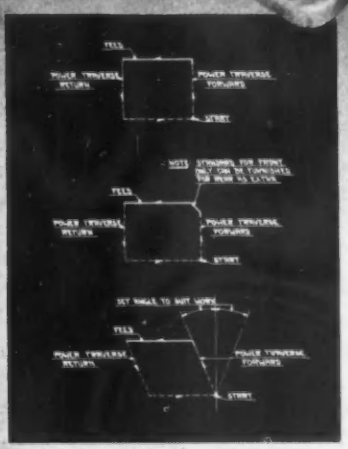
Standard Cycles

...FRONT and REAR!





THE No. 3-A DUOMATIC LATHE is a full automatic lathe for the advantageous use of multiple tools in turning and straight and angular facing operations. It is particularly adapted to quantity production of lathe work in small or large lots whether between centers on an arbor or in suitable chucks or fixtures.

Write for Descriptive Booklet, No. 601-FL.

Oct. 8, 1943
Feb. 23, 1943
Aug. 23, 1942
March 6, 1942

THE LODGE & SHIPLEY MACHINE TOOL CO.
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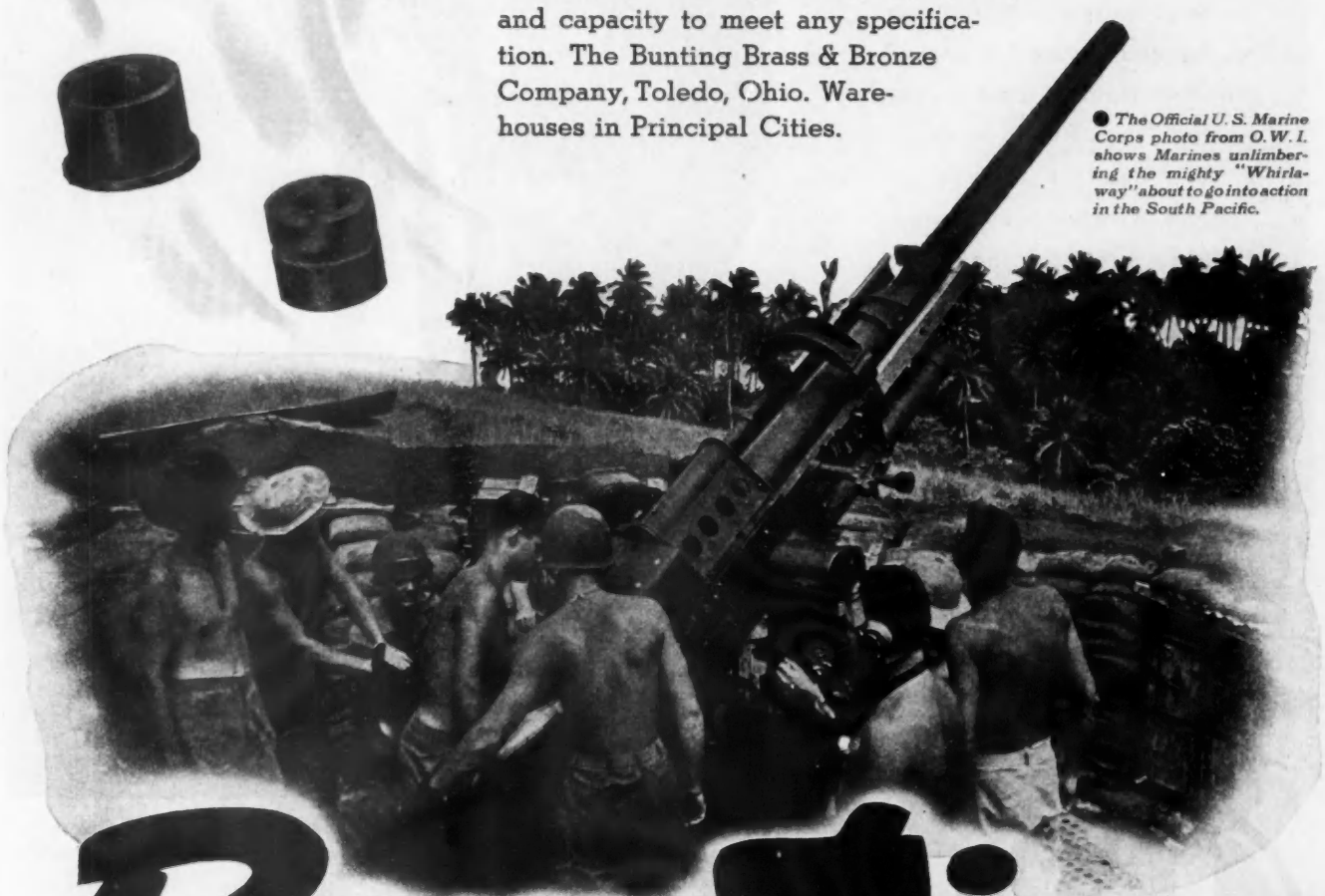
BEARINGS FOR THE BIG GUNS

● On the production line of battle the big gun is the machine tool of war—the mass destroyer. Up-to-date engineering and modern production methods are enabling the United States to produce better guns and more guns than any single nation ever before has made.

It is significant that Bunting Bronze Bearings are in the gun mounts made by Worthington Pump and Machinery Company for the famous "Whirlaway" (90 mm anti-aircraft), in the sight assemblies made by The Goss Printing Press Company for the outstanding 5-inch dual purpose gun, and in the operating mechanisms made by Duplex Printing Press Company for the deadly 37 mm anti-tank gun, and in many other big guns.

If you have a bearing requirement or problem look to Bunting for the experience, equipment and capacity to meet any specification. The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in Principal Cities.



● *The Official U. S. Marine Corps photo from O. W. I. shows Marines unlimbering the mighty "Whirlaway" about to go into action in the South Pacific.*

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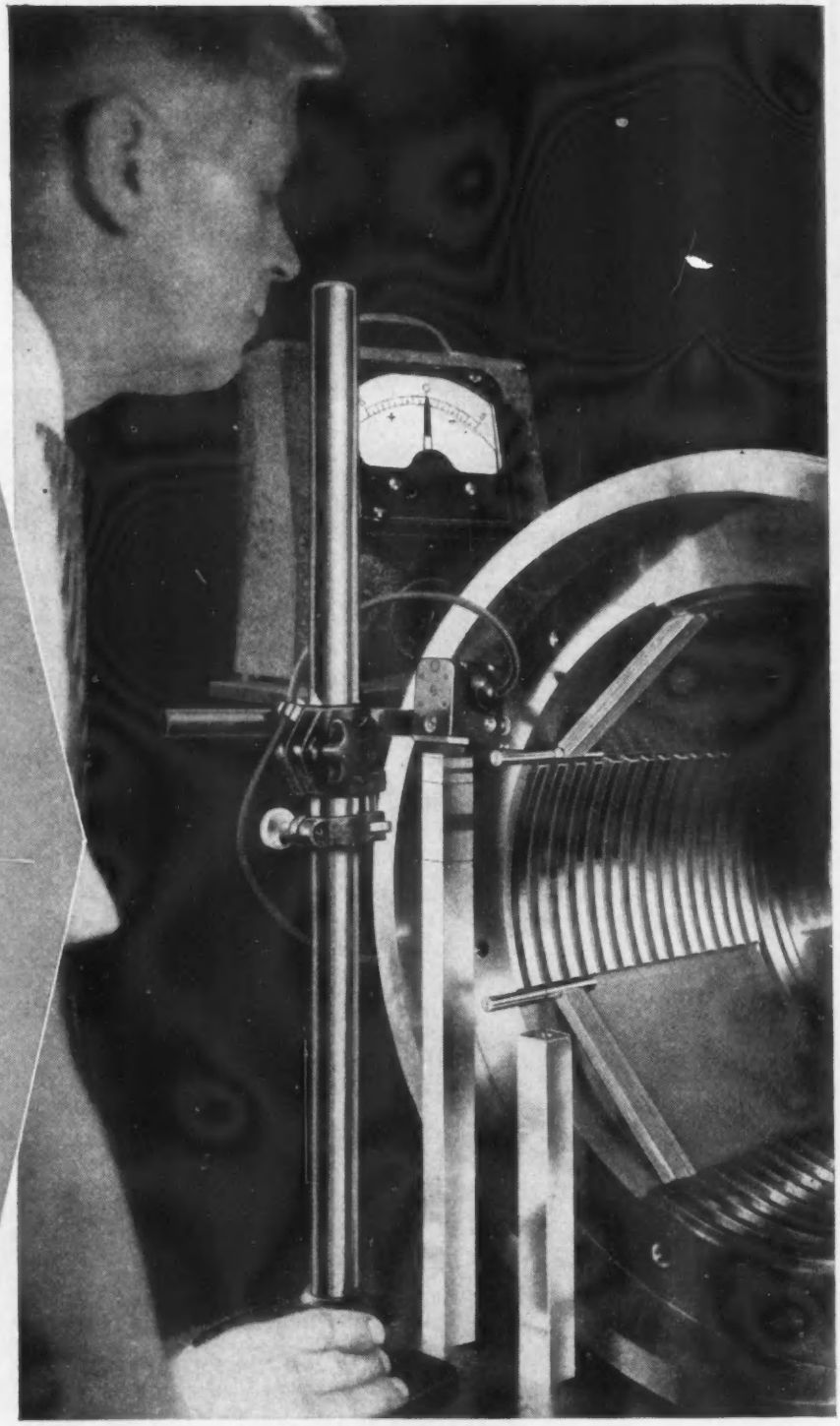
ACCURACY cannot be rushed . . . not the kind of accuracy that Pratt & Whitney has supplied to industry these past 83 years.

We know full well the desperate pressure and rush of war production . . . we've served faithfully through many of our country's wars. But never in any of these emergencies has the Pratt & Whitney standard of accuracy been sacrificed for speed. Enlarge our facilities . . . yes. Add and train thousands more men . . . yes. But lower our standard of accuracy . . . never. Through peace and war, Pratt & Whitney machine tools, small tools, and gages are made to one rigid standard of accuracy which has never changed.



Accuracy — to millionths of an inch — at work on the war production front. A skilled craftsman uses a stack of P&W Hoke Precision Gage Blocks to check a vital point in a breech block gage.

Since World War I — when P&W pioneered and perfected the manufacture of these Hoke Precision Gage Blocks — they have steadfastly remained *the* basic standard of measurement.

PRATT & WHITNEY

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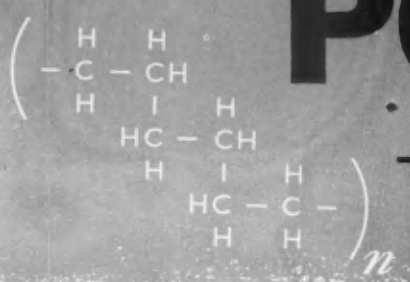
ANNOUNCING A NEW PLASTIC BY DU PONT

POLYTHENE



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Light in weight, extremely low in water absorption and moisture permeability, exceptional electrical properties

Now—after five years of intensive experimentation and development work—Du Pont announces polythene.* This is a new and unique plastic suitable for a wide variety of applications. Developed by Du Pont under basic U.S. product and process patents (U.S.P. 2153553 and 2188465)—exclusive rights to which are owned by Du Pont—polythene is in production to meet certain war needs.

Several distinct advantages indicate the use of polythene for many applications long considered the proper sphere of plastics but impossible with materials available up to now. Note these special properties:

LOW WATER ABSORPTION—not more than 0.075% (A.S.T.M. method D 570-42). Water vapor transmission —0.4 grams per square meter per 24 hours at 25°C, 0.004" thickness (A.S.T.M. method D697-42T).

HIGH DIELECTRIC STRENGTH—1000 v/mil at 0.01" thickness, dielectric constant 2.2—2.3, with a power factor of less than .0005 over a wide range of frequencies.

VERY LOW SPECIFIC GRAVITY—0.92—0.93.

UNUSUAL LOW-TEMPERATURE FLEXIBILITY.

REMARKABLE CHEMICAL INERTNESS—resistant to water, alkalies, acids, and oxygenated solvents.

READY MOLDING AND FABRICATION BY PRESENT METHODS—with existing thermoplastic molding and shaping equipment. Polythene powder can be extruded, injection molded, compression molded and calendered. In sheet, rod or tube form it can be machined, cut, blown, blanked or swaged.

ADDITIONAL FACTS ABOUT DU PONT POLYTHENE—In stiffness, polythene lies between the so-called rigid and non-rigid types of plastics. Its tensile strength is 1500 psi. It is slow burning. It is soluble in hot aliphatic, aromatic, or chlorinated hydrocarbon solvents.

WIRE AND CABLE COVERING—the remarkable electrical properties and ease of extrusion of Du Pont polythene indicate wide usage in this field.

NOW AVAILABLE—polythene is available now in production quantities only by specific authorization through WPB order M-348. However, small lots for experimental purposes may be secured on proper application. Write for polythene properties chart and other data which will suggest to you ways in which you might take best advantage of the unusual qualities of this new plastic for war work. Address inquiries to E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, New Jersey.

**A generic name for a solid, tough polymer from ethylene*

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An ever-growing family whose newest member is polythene

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BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*

After it's over

Soon, we earnestly hope, twelve million young men and women whom we will never be able adequately to repay, will come home asking what we have done in the country *they* saved. We'd better have the right answers. One thing: for all of them we *must* have, or make, jobs with the least loss in time and money to them.

The first year after the war, civilian needs will require food and equipment representing at least 165 billion dollars in salaries, wages and material. Thanks to fast and vast war production, agriculture and industry will have the experience and efficiency to perform the task. New machinery of unprecedented capacity will need millions of men and women to operate it with an ease and skill that will provide more comforts on and off the job.

Already, The Harrisburg Steel Corporation has completed, and is developing plans for new products to fill replacements and to perform new services that a war depleted world must have. Whether it be a pump liner for an oil field, a seamless steel cylinder for a stratoliner or a future appliance yet to be revealed, every "Harrisburg" product will include over ninety years of know-how in fine steelmaking.

"Harrisburg" identifies the world's largest producer of seamless, plate made high pressure cylinders, as well as specialists in the production of alloy and carbon steels, pipe couplings, pump liners, liquefiers, hollow and drop forgings, pipe flanges, coils, bends and aerial bombs.

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MAIN HQ EIGHTH ARMY.
C.M.F.

My dear Gatehouse

18 SEPT. 43

... We have during our past battles been equipped with many types of American tanks, designed and developed by the Ordnance Department, United States Army, and so ably produced by American industry. Each one has proved itself in battle to be a first class machine and has enjoyed the full confidence of the crews which have fought with them.

The first tank we had was the .... Light M3, made by the American Car and Foundry Company. This is one of the most reliable and handy tanks that has ever been produced. It fought in the desert battle in Libya in 1941 and has fought with distinction in every battle since that date. We have them with us here in SICILY where again they have proved invaluable.

Yours sincerely
B. L. Montgomery
General
Eighth Army.

"THE HONEY"

"We quickly termed these original M3 Tanks 'The Honeys,' and with them we were very largely responsible for the severe defeat inflicted upon Field Marshall Erwin Rommel in October and November, 1941."

Major General A. H. Gatehouse, DSO, MC
British Ministry of Supply Mission

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BROWN-LIPE CLUTCHES AND TRANSMISSIONS • SALISBURY FRONT AND REAR AXLES • SPICER UNIVERSAL JOINTS • PARISH FRAMES, STAMPINGS

It's a New Year's Question

WHY GET A WELLS NO. 8?

WELLS No. 8
Capacity: Rectangle—8" x 16"
(spec. bowed guides)—5" x 24"
Rounds—8" dia.
Speeds: ft. per min. 60, 90, 130
Motor—Specifications optional

No. 20
Designed for cutting risers off propeller blades

No. 12
Heavy duty production Saw

No. 9
General Foundry Saw

STOCK STANDS
Indispensable item for your shop

Wells SAWS
THE SIGN OF SERVICE

Here's why!

VERSATILE — Wells No. 8 Metal Cutting Band Saw will cut a wide variety of metals in various shapes. In single or ganged-up work it will take overall sizes up to 8" x 16" rectangles or 8" rounds.

ACCURATE — Vibrationless operation assures uniform cutting.

FAST — The continuous cutting method employed insures a cool blade thus enables the operator to obtain maximum cutting speed for the type of stock being cut. Adjustable to 3 speeds.

ECONOMICAL — Cutting capacity and quality are paramount factors in choosing a WELLS Saw. Then too, it requires but a ½ H.P. motor and 2' x 6' of floor space.

Ask your mill-supply dealer to show you a WELLS, Model 8, in actual operation — you'll like its performance.

A large stock of blades is available at all times

To get complete specifications on WELLS Saws, write for the new WELLS Catalog.

Wells Has Established Leadership

WELLS MANUFACTURING CORPORATION

Wells METAL CUTTING BAND SAWS

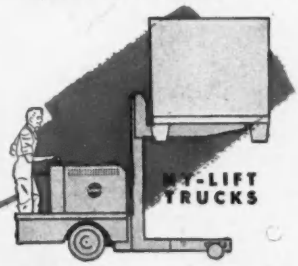
101 JEFFERSON STREET • THREE RIVERS, MICHIGAN

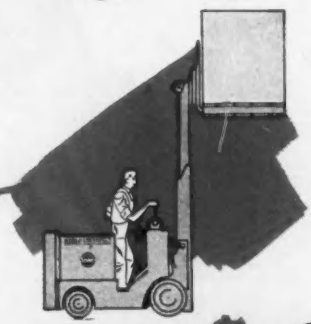
NEW Baker Truck Catalog GIVES THE ANSWERS TO YOUR MATERIAL HANDLING PROBLEMS

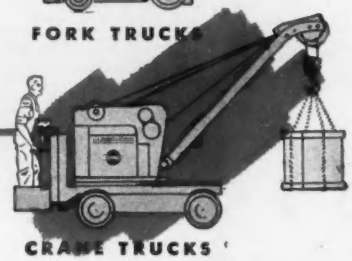
Here's real help for any plant or warehouse faced with transportation problems. The Baker Electric Truck Catalog No. 52 is more than a catalog. It is a handbook of information on material handling with power trucks, designed to facilitate selection of the proper equipment for any set of requirements. In addition to describing the 47 standard Baker Electric Trucks, it covers many special models designed for unusual handling operations.

Actual case histories featured throughout the book show Baker Trucks of all types speeding production, saving time and money and conserving man-power in a wide variety of installations. You are almost sure to find problems comparable to those in your plant, and you can profit from the experience of others in solving them.

LOW-LIFT TRUCKS


HI-LIFT TRUCKS


FORK TRUCKS


CRANE TRUCKS

TRACTORS

PLATFORM TRUCKS

Plant and production managers, traffic managers, superintendents, purchasing agents and any others concerned with material handling will find this book a valuable source of information. Write for your copy of The Baker Electric Truck Catalog No. 52 today.

BAKER INDUSTRIAL TRUCK DIVISION

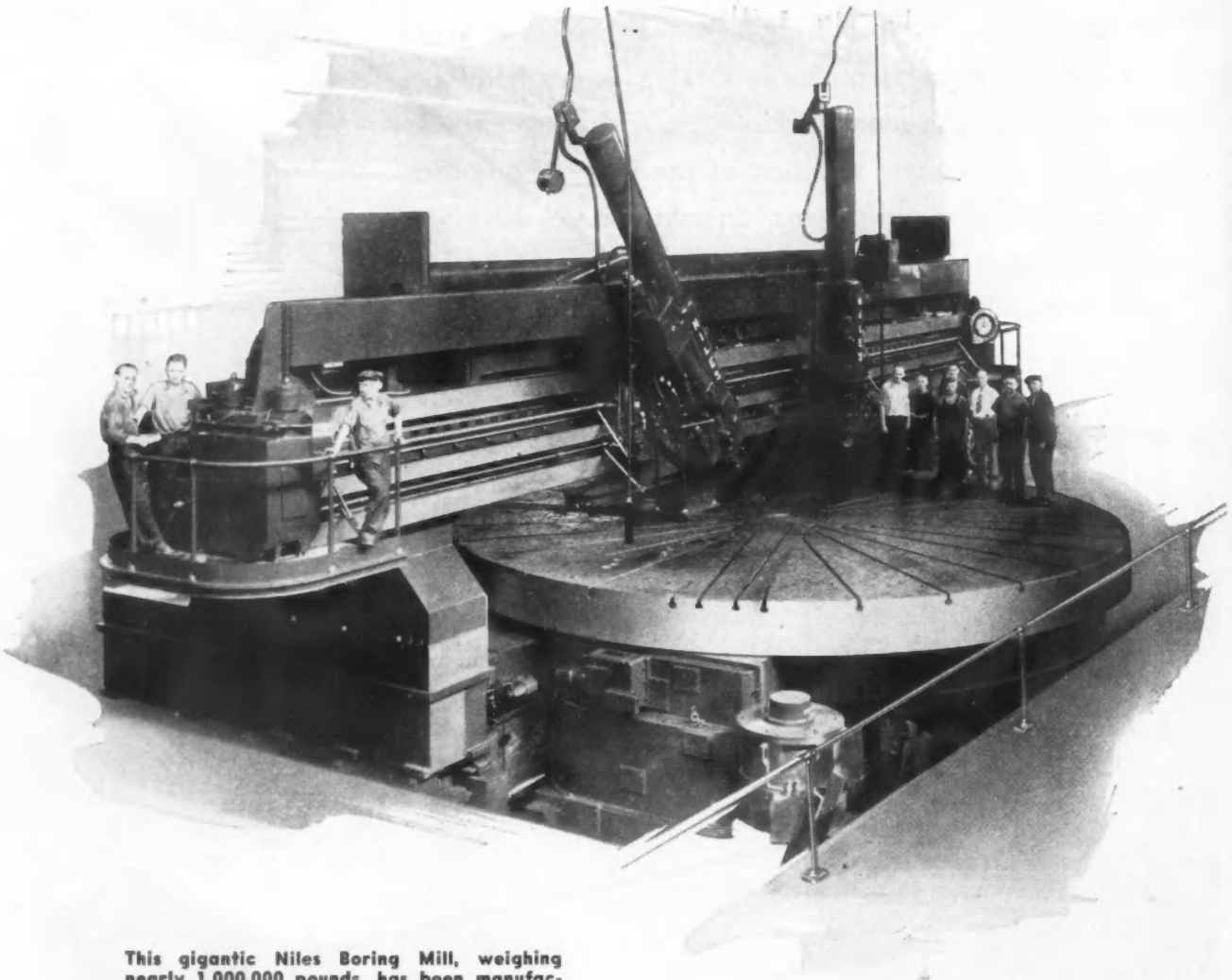
2154 WEST 25th ST. *of the Baker Raulang Company* CLEVELAND, OHIO

In Canada—Railway and Power Engineering Corporation, Ltd.

Baker INDUSTRIAL TRUCKS

IT COULDN'T BE DONE

SO GENERAL MACHINERY DID IT



This gigantic Niles Boring Mill, weighing nearly 1,000,000 pounds, has been manufactured for and delivered to a government arsenal by the Niles Division, Hamilton, Ohio, of General Machinery Corporation.

GENERAL MACHINERY CORPORATION

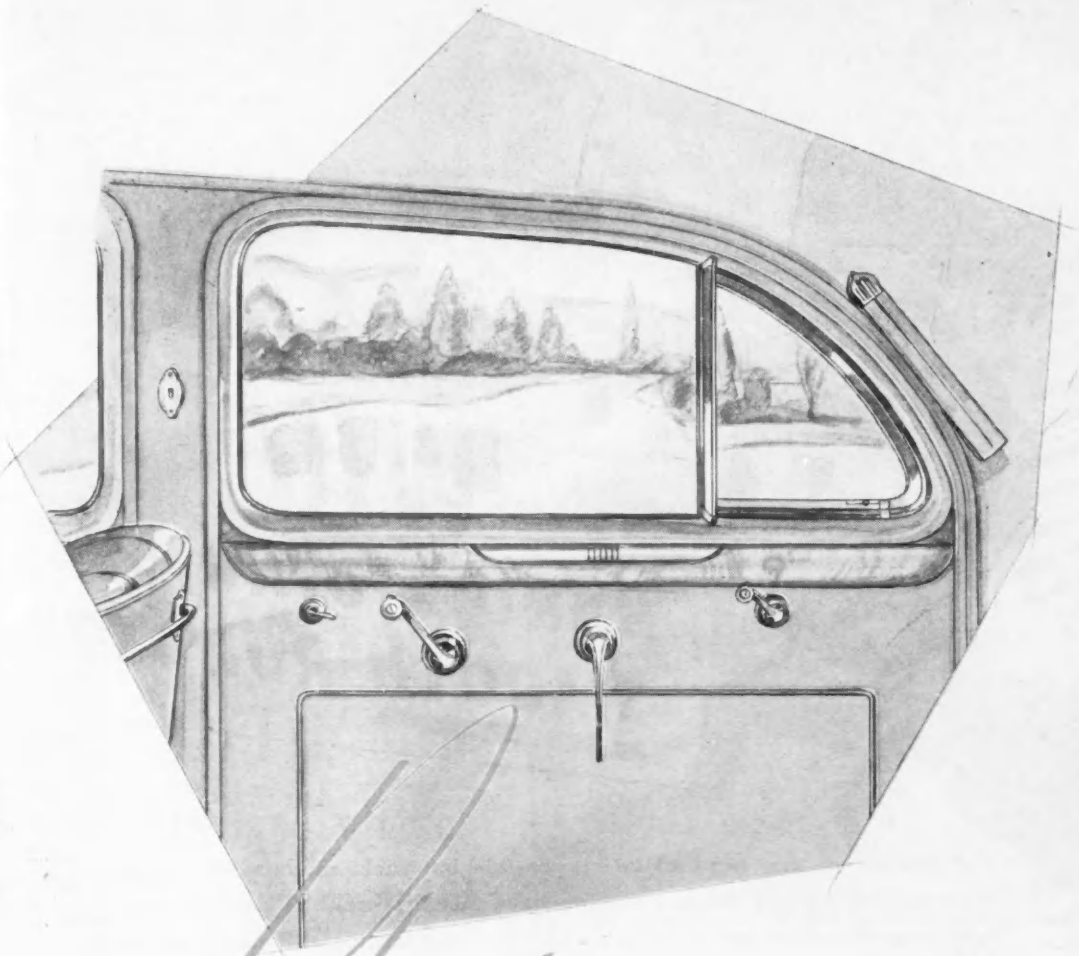
GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION



Plastic BODY INTERIORS ARE **SPARKLING, SANITARY!**

The next step in the development of body interiors is the application of flexible Formica plastic sheets to door panels, seat backs and similar surfaces.

The dense, non-porous surface does not absorb dust or grease and is easily kept clean with a dust cloth, soap and water, or if necessary solvents such as alcohol and gasoline. The surface is spot-proof and very durable.

Any color is practical and there are many patterns of fabrics, wood grains, or conventional designs that may be provided—a color or treatment to harmonize with any scheme.

The flexible sheets may be sewed, glued or mechanically held. They present no difficulties in production.

"The Formica Story" is a moving picture in color that shows the qualities of Formica, how it is made, and how it is used. Available for meetings of engineers and executives.

The Formica Insulation Company • 4612 Spring Grove Avenue, Cincinnati 32, Ohio

FORMICA

"WHAT! HARD RIDING ON SMOOTH ROADS?"

● Mister, you may not believe it is possible, but trucks and buses equipped with *ordinary* shock absorbers often have just that trouble. Because ordinary shock absorbers are in *constant tension*. This tension stiffens the action of the vehicle's springs, and actually causes hard riding on smooth roadways.

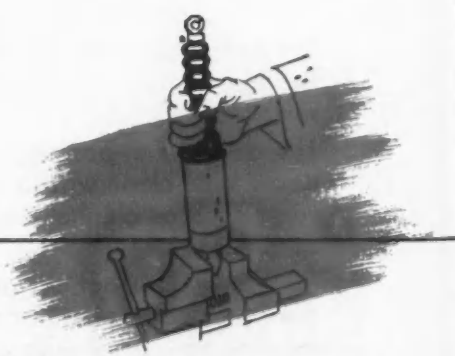
CLE-AIR Shock Absorbers overcome this problem with the *"floating-center principle"*. This means that the piston of the Cle-Air unit can "float" freely in the cylinder on smooth roads, and normal spring action is unrestricted. But when the wheels hit a bump, the shock absorbing and snubbing action of the Cle-Air unit acts quickly, preventing both jarring and swaying.

Cle-Air Shock Absorbers have other important advantages:

1. They are *double-acting*—both hydraulic and pneumatic.
2. Properly serviced they will last as long as the vehicle.
3. Suitable for all types of buses, trucks and trailers.

Write for complete information.

THE CLEVELAND PNEUMATIC TOOL COMPANY
AUTOMOTIVE DIVISION
CLEVELAND 5, OHIO



THE "*Floating-Center*" PRINCIPLE AT A GLANCE!

If a Cle-Air unit is clamped in a vise, the piston can be easily moved up and down, with the hand. But if the piston is struck by a hammer (corresponding to a road bump) the piston snubs instantaneously.

CLE-AIR
HYDRAU-MATIC SHOCK ABSORBERS

POWER TO LIFT A TANK in the palm of your hand!

★ It weighs less than 4 pounds. It's so compact you can hold it in the palm of your hand. But it delivers enough pressurized power to lift a General Sherman tank. That's the amazing, new PESCO Pressure-Loaded Hydraulic Pump!

Never, until PESCO engineered it for modern aviation, was there so small a pump of equal displacement capable of delivering 3000 p.s.i. Radical improvements in design plus precision manufacture of the highest order are the ingredients.

Through PESCO design, entirely new opportunities are opened up for the more practical and efficient use of hydraulics in your product or plant. And that goes for controlled liquid flow as well as pressurized power. For PESCO's advanced design and performance extends through a complete line of hydraulic, pneumatic, vacuum and fuel pumps and pumping systems. Practically without exception, the precision equipment PESCO makes has been engineered to specifications of performance never dreamed of before modern aviation.

We would welcome the opportunity to tell you of our facilities to engineer PESCO equipment to meet your own specific problem. PESCO Engineering Service is available to you. Just write.

SEND FOR THIS BOOK "Pressurized Power and Controlled Flow by PESCO". This book pictorially tells the story of PESCO equipment, manufacturing facilities and engineering service. A copy will be mailed promptly upon request.

WRITE TO...
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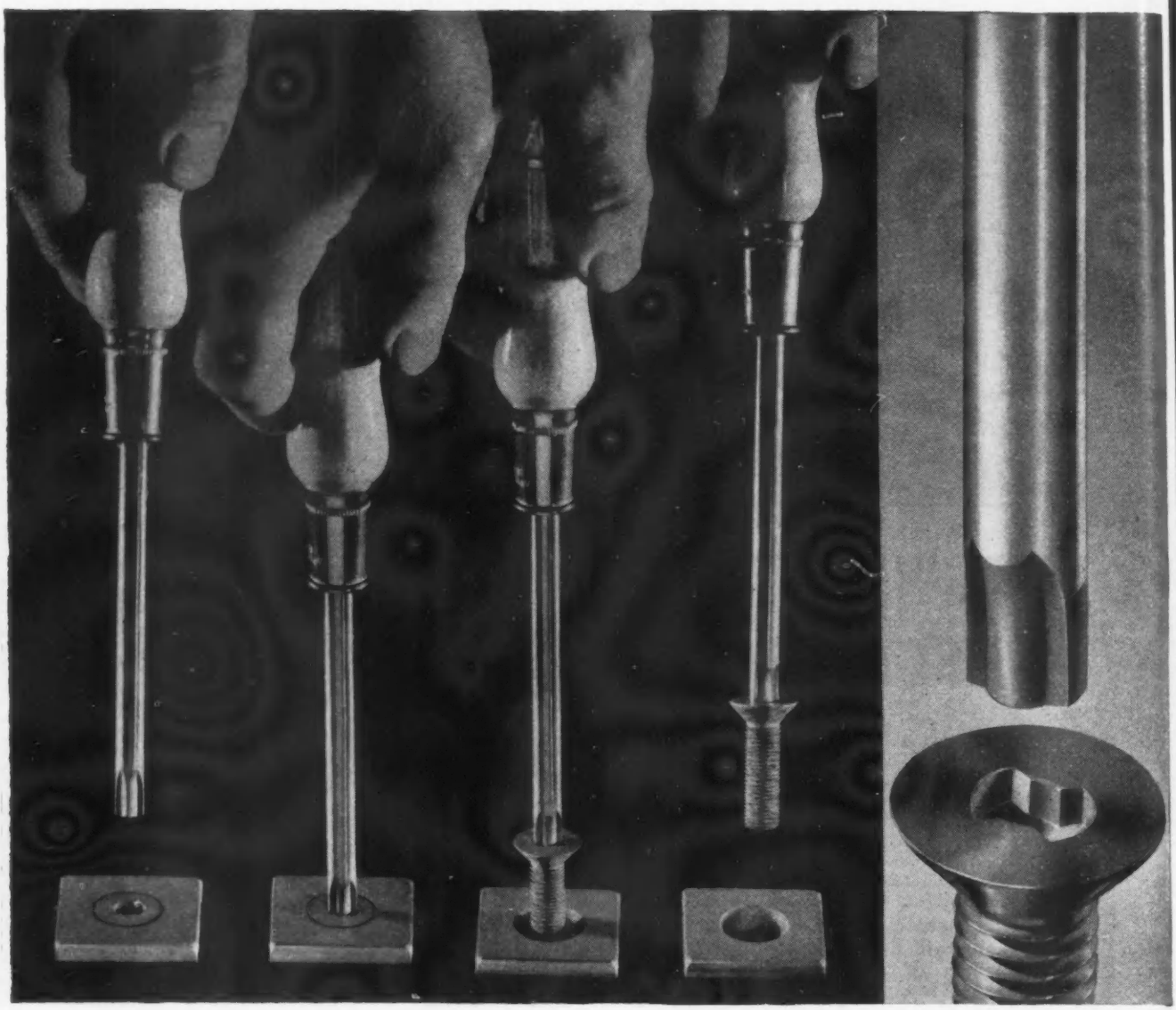
Division Borg-Warner

In Precision Hydraulics, Fuel Pumps, Air Pumps, Related Accessories . . .
PERFORMANCE POINTS TO Pesco FIRST



When the job has to be "Un-buttoned" . . .

. . . when screws painted-in, rusted-in, or "frozen-in" have to be *removed, saved, and used again* . . . here is a tool that eliminates this serious problem of field maintenance. This rugged Center Pivot hand driver, as used with CLUTCH HEAD Screws, is the answer. Note its structure; its careful engineering to make a deep dead-center entry to engage the straight walls of the Clutch with a powerful torque that breaks the "freeze" of any screw for straight, easy, and *undamaged* withdrawal. More than that, this simple tool *saves the screw for re-use* because the withdrawal action automatically unites the screw and driver as a unit . . . to prevent trouble and possible danger arising from dropped and lost screws. In addition to speeding and simplifying normal field adjustments, this positive Lock-On feature frequently saves disassembling surrounding units by furnishing dead-sure access *to and from* these otherwise impossible or hard-to-get-at spots.

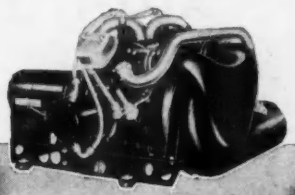
CLUTCH HEAD · SCREWS ·

For closer personal understanding of this and other exclusive CLUTCH HEAD *features, may we send you an assortment of screws and a sample Center Pivot Bit . . . along with illustrated Brochure on* CLUTCH HEAD *Screws?*

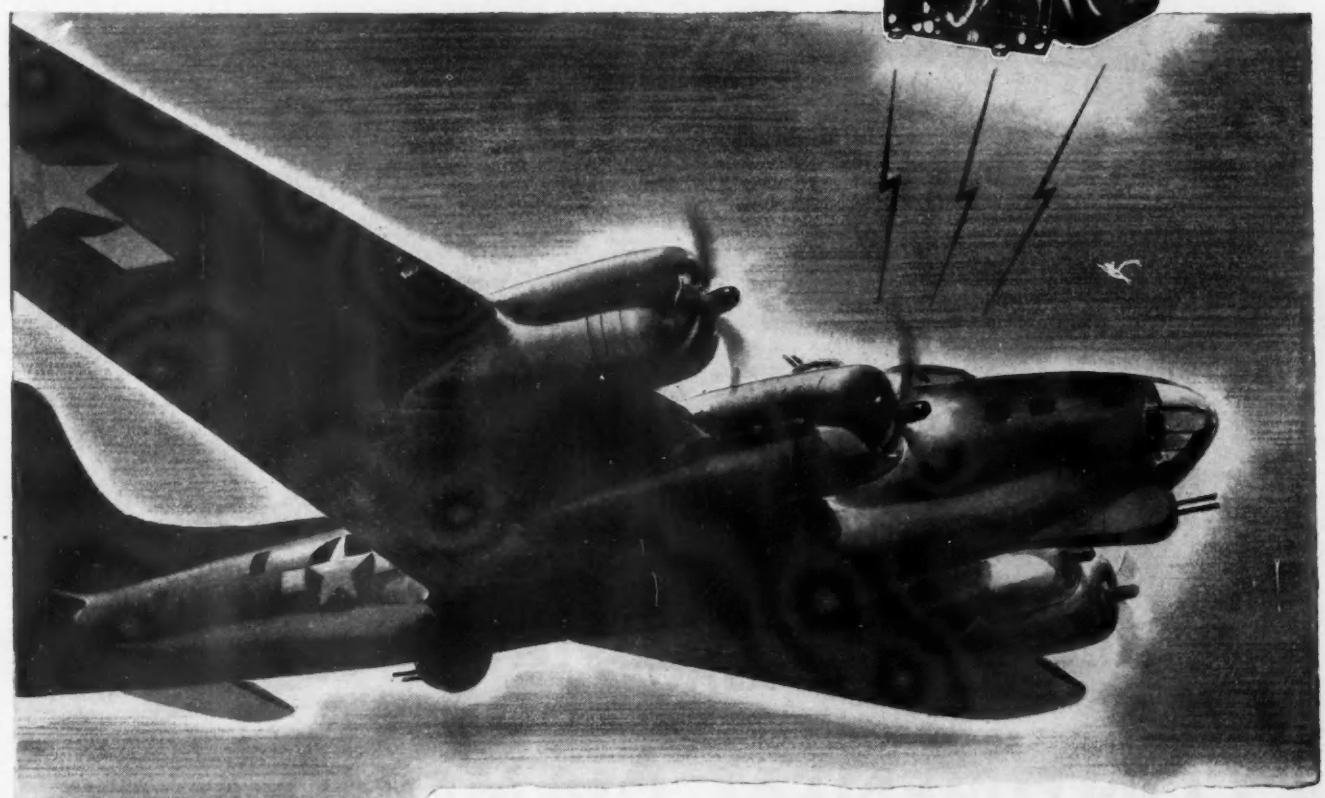
UNITED SCREW AND BOLT CORPORATION

CHICAGO CLEVELAND NEW YORK

NO POWER WORRIES



7½ KW
116 LBS.



—with an AUXILIARY POWER UNIT on the job!

Engine alone weighs 81 lbs. 15 oz. *The complete Andover Auxiliary Power Plant consists of a two-cylinder air-cooled 10 H.P. engine driving a 28.5-volt generator supplying a continuous power output of 5 K. W. with a peak load of 7½ K. W. Its complete weight with generator and adapter is only 116 lbs.*

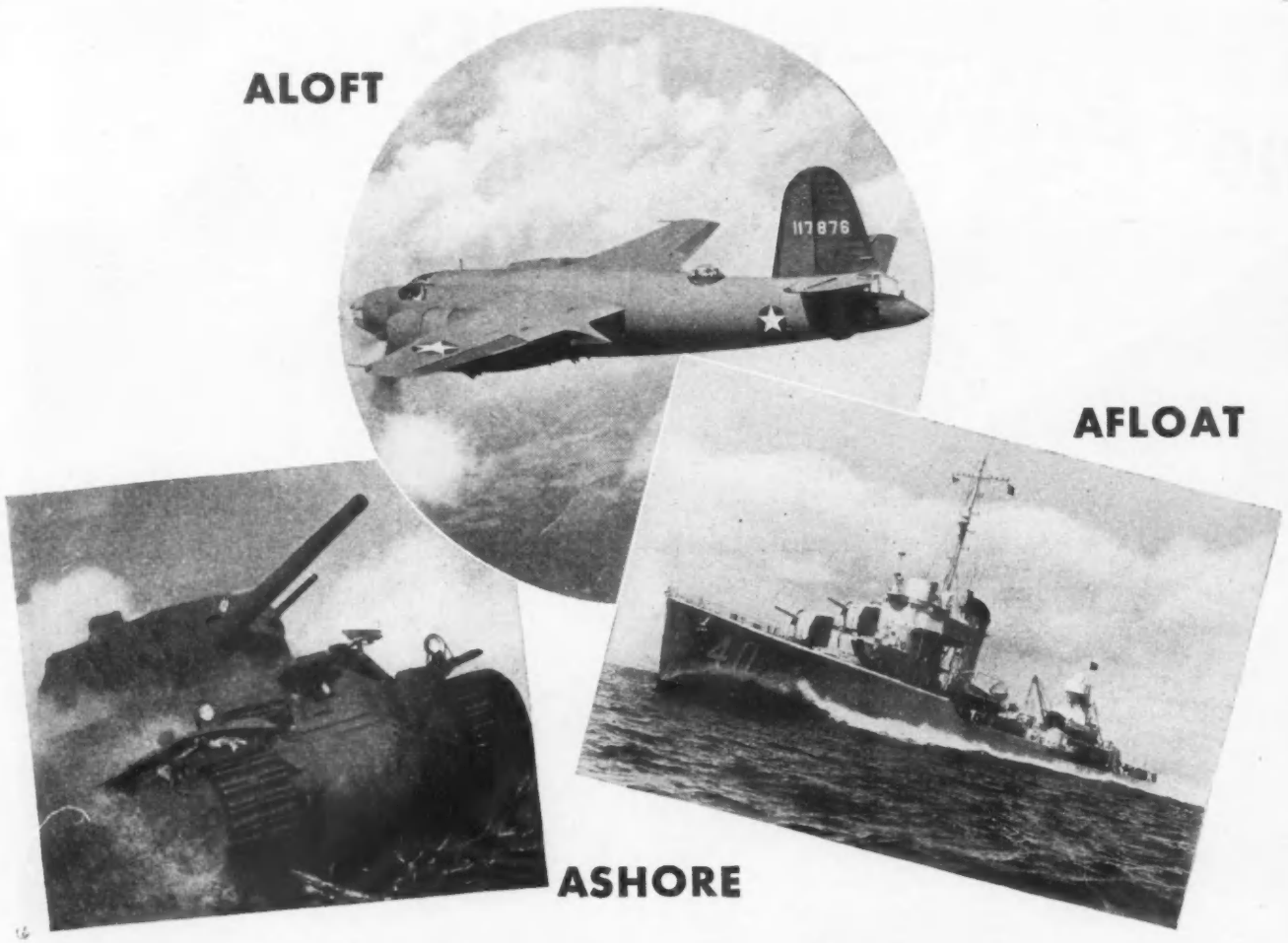
Before take-off . . . in the air . . . or in the event of an emergency landing, the crew of a modern bomber has *no power worries* — the Andover Auxiliary Power Unit stands ready to supply continuous, dependable electric power on demand.

Therefore, this gives the bomber crew a security of having *constant* electric power always available to operate essential battle accessories — bomb-bay doors, turrets, interplane communication system, radio, instruments, landing gear, etc. — which completes a vital link for safe, successful operations over enemy territory.

Today, these compact, light-weight powerhouses are helping to bring our boys back safely. Tomorrow, these same units will serve our boys in every business where portable electric power is needed.

ANDOVER MOTORS CORPORATION • ELMIRA, N. Y.

WHOLLY-OWNED SUBSIDIARY OF ANDOVER KENT AVIATION CORPORATION



A CONTINENTAL DIAMOND *product*

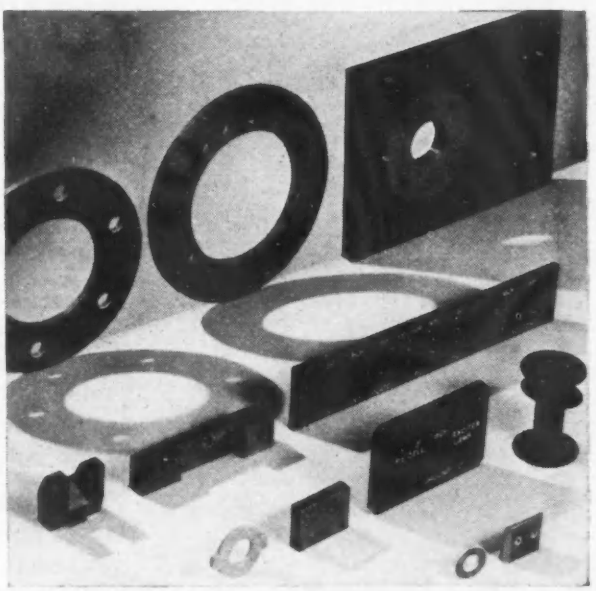
is in there slugging!

C-D makes hundreds of electrical and mechanical parts which are vital to the successful operation of radios, guns, controls, communication systems, and all electrically energized units in our fighting equipment afloat, ashore and aloft.

Many of these applications posed new problems and conditions for NON-metallics. The research and experience which resulted has provided our laboratory with a wealth of "know how" which is at your disposal to help solve your "What Material?" problems.

C-D products include THE PLASTICS... DILECTO—a laminated phenolic: CELORON —a molded phenolic: DILECTENE—a pure resin plastic especially suited to U-H-F insulation . . . THE NON-METALLICS, DIAMOND Vulcanized Fibre: VULCOID — resin impregnated vulcanized fibre: and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

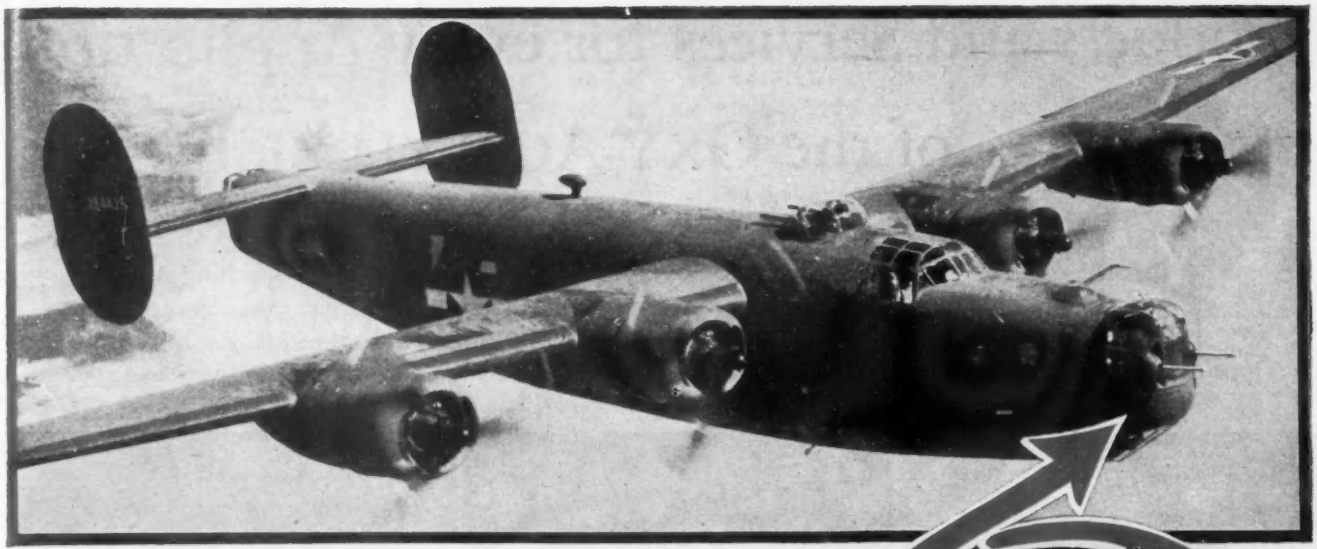
DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C. West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities



CD-43

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE



Flight picture of a B-24 Liberator equipped with the new Emerson-Electric nose turret.

Emerson-Electric Builds *New Fighting Power* For the Air Offensive - - -

Close-up view of the new nose turret, equipped with two .50 cal. guns.

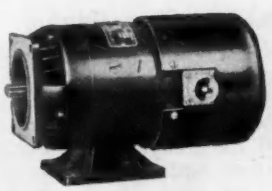
Now it can be told—the interesting story of the development of the new nose turret designed and manufactured by Emerson-Electric for B-24 Liberators!

It began when Emerson-Electric was given the assignment of building a turret having maximum fire power with proper visibility, safety and comfort for the gunner.

The model B-24 nose turret designed by Emerson-Electric engineers, having these characteristics, passed a series of critical Army tests and was released for production immediately.

In addition to this powerful new weapon, Emerson-Electric has been producing in large quantities, upper-deck and lower ball power-operated airplane gun turrets used on the B-17 Flying Fortress, top turrets for Navy Avenger Bombers, and also top turrets for Army medium two-motor bombers.

Emerson-Electric is continuing to pioneer in the development of new and more effective armament for the air offensive—for quicker Victory through air power.



EMERSON-ELECTRIC AIRCRAFT MOTORS are made for gun turret drives, hydraulic units, fuel pumps, actuators, winterizing units, communication systems—also with built-in gear and magnetic brake.

THE EMERSON ELECTRIC MANUFACTURING CO.
SAINT LOUIS • *Branches:* New York • Chicago • Detroit
Los Angeles • Davenport

Emerson-Electric is now engaged 100% in producing equipment for the armed forces of the United States.

356

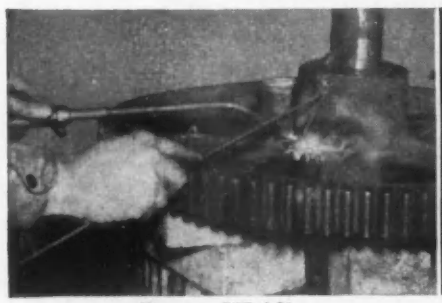
EMERSON ELECTRIC

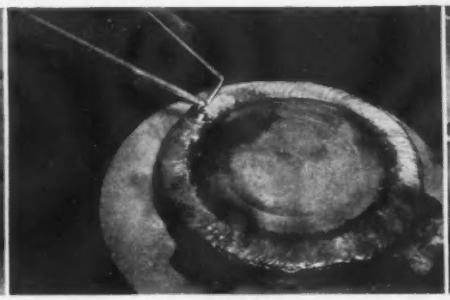
MOTORS • FANS • APPLIANCES

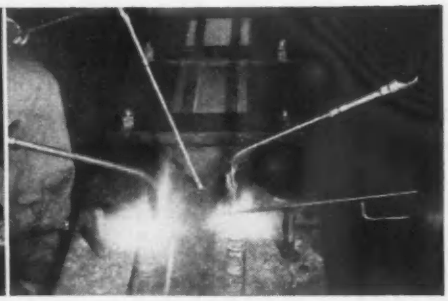
Products and Services for every Application of the OXY-ACETYLENE Process

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

Oxy-acetylene processes are used throughout industry to speed up production, to conserve materials, to lower operating costs, and to simplify problems of maintenance and repair. Some of the many oxy-acetylene applications are outlined here.





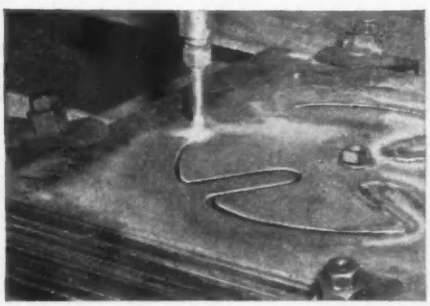


Bronze-Welding **Resurfacing** **Hard-Facing**

The oxy-acetylene flame makes possible the joining of practically any metals—like or unlike—so that the weld is as strong as the base metal itself. *Bronze-welding* speeds the repair of cracked or broken steel and iron parts right on the job. *Resurfacing* of worn parts with steel, iron, bronze, or other types of welding rod avoids delays and conserves materials. *Hard-facing* with Stellite alloys makes parts that are subject to abrasion, heat, or corrosion last from two to twenty-five times longer. Welded piping systems use less fittings, occupy less space, and remain leakproof and maintenance-free indefinitely.

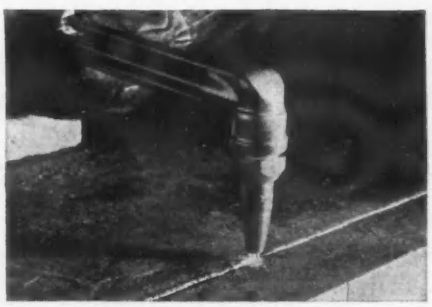
Machine Shape-Cutting

Shape-cutting quickly produces simple or intricate steel shapes with clean-cut edges that usually require no machining. This method is also used for bar and billet cut-off, for straight-line cutting, and for preparation of plate edges prior to welding.



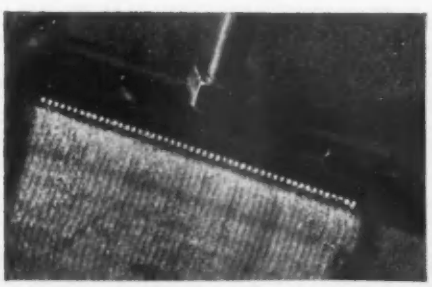
Stack-Cutting

Stack-cutting of tightly clamped piles of plate is an adaptation of shape-cutting to permit fast production of quantities of identical parts. This oxy-acetylene method usually is faster and more economical than shearing or other mechanical methods.



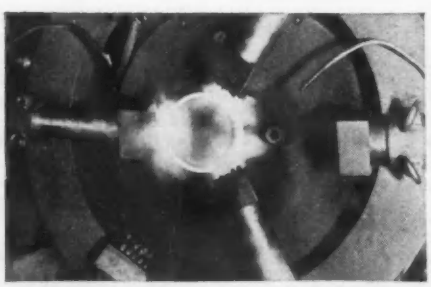
Hand-Cutting

Hand-cutting speeds the cutting of structural steel to length, quickly severs gates and risers to reduce machining, and facilitates alteration work. With Oxweld gouging nozzles, a groove of surface metal can be removed without harm to adjacent areas.



Flame-Priming

This process removes loose scale, rust, and surface moisture from steel prior to painting—making paint go on faster, bond tighter, and last longer.

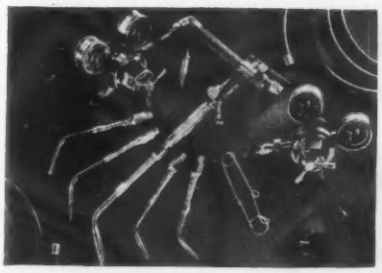


Flame-Hardening

This oxy-acetylene process is used to impart a hard, wear-resistant case to steel and iron parts without affecting the toughness of the core.

Heating

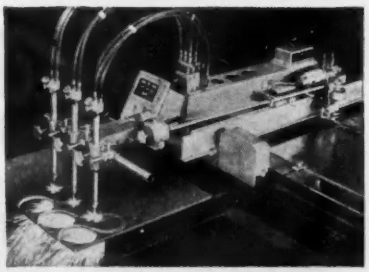
Heating for bending, straightening, and forming operations is facilitated by the oxy-acetylene flame. Shown here, a pipe is being wrinkle-bent.



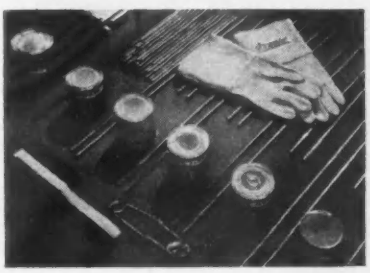
Hand Apparatus

Oxy-acetylene apparatus which may be ordered from Linde includes oxy-acetylene blowpipes for all welding and heating work; oxy-acetylene cutting blowpipes, cutting attachments, and nozzles; and oxy-acetylene descaling and flame-priming equipment. Oxweld apparatus is supplied from Linde offices and warehouses. The Purox and Prest-O-Weld lines are distributed by industrial and automotive jobbers. Prest-O-Lite air-acetylene appliances for soldering and brazing are also distributed by these jobbers.

Machine Apparatus



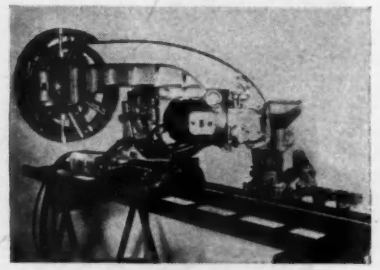
Included in the complete line of Oxweld apparatus are portable and stationary oxy-acetylene shape-cutting machines; straight-line cutting machines; flame-hardening apparatus; bar and billet cut-off machines; equipment for automatic welding; and tractor units for plate-edge preparation.



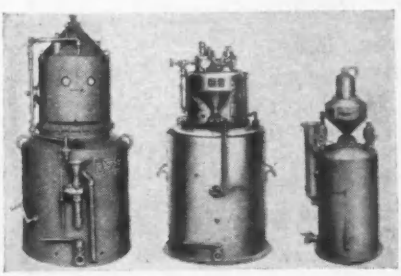
Welding Rods, Fluxes, and Supplies

Oxweld welding rods and fluxes are of exceptionally high quality. The many kinds and sizes of Oxweld rods make it possible to select the one that will give best results on each job. The Oxweld line also includes gloves, goggles, lighters, hose, ferrules, and asbestos paper. Rods, fluxes, and supplies may be ordered from Linde or from automotive and industrial jobbers.

Unionmelt Welding



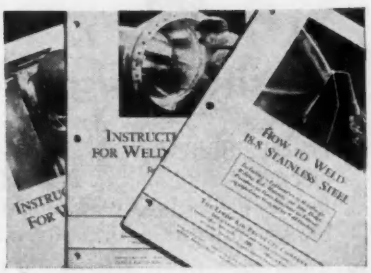
This unique electric process makes high-quality welds in any commercially used thickness of steel — in one pass—and without flash, glare, or sparks —at speeds as much as twenty times greater than similarly applicable methods. The process is fully automatic. Speed and current values are established by electric controls adjusted by an operator.



Generators and Manifolds

Oxweld acetylene generators produce low-cost acetylene and are made for both portable and stationary use—with maximum generating capacities of from 30 to 9,000 cu. ft. per hour. Oxweld oxygen and acetylene manifolds are used for centralizing the oxygen and acetylene supply from cylinders.

Process Literature



Linde makes available to customers an extensive library of process literature which contributes to the knowledge of operators and shows how to use the oxy-acetylene process profitably.

Send for This Catalog—

For a more detailed description of Linde processes, and for more information about availability of Linde products, process literature, and process service, send for the descriptive, 8-page catalog shown here.

Oxygen, Acetylene, Carbide

Linde oxygen, Prest-O-Lite acetylene, and Union Carbide are distributed through numerous Linde plants and warehouses located to assure dependable deliveries and low transportation costs. This reflects Linde's efforts to help assure availability of these materials.

The words "Stellite," "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," "Prest-O-Weld," and "Unionmelt" are trade-marks.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

IS YOUR POWER SYSTEM OVERLOADED?

Do You Want More Capacity . . . Quickly . . . Inexpensively?

CAPACITOR PLUG mounted on BUStribution DUCT (handle on plug cover permits operation from floor).

Capacitor Plugs help in these ways!

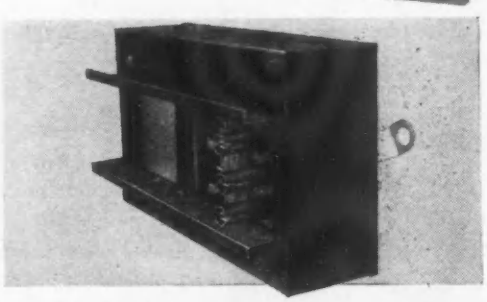
1. Inserted in any of the plug-in openings of your BUStribution DUCT, BullDog Capacitor Plugs increase the capacity of your electrical system by reducing the reactive KVA, thus ensuring lower operating temperatures and preventing needless fuse blows and production shutdowns.
2. They permit installation of Capacitors at the nearest point to your motors. As the load center shifts, the plug-in Capacitors can be shifted with it.
3. They represent a *decentralized,* and consequently more flexible, arrangement of Capacitors. Even if a unit should fail, the power factor correction of the entire system would not be affected, as it would with *centralized* banks of Capacitors.
4. They make possible the strategic location of Capacitors at the points in the system where poor power factor occurs, and this improves conditions for the rest of the equipment all the way back from the motors, through the bus duct, through the secondary switchboard, to the transformers.
5. Capacitor Plugs not only improve your power factor, but save valuable space and critical materials such as copper and steel . . . to say nothing of man-hours and production saved because of fewer blown fuses and greater operating efficiency.

BullDog field engineers are as close as your telephone for complete details . . . or write us direct.

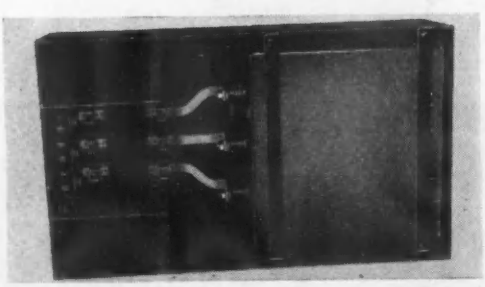
FOR A BRIGHT FUTURE BUY MORE WAR BONDS

New BullDog Capacitor Plug

You don't have to worry about space or supporting means for these Capacitors. Just plug them into the BUStribution Duct. It's as quick and easy as that! Rated from 1 to 15 KVA, complete with fusible switch or circuit breaker in one compact handy Plug for 230V or 460V 60 cycle.



Rear view of Plug showing bus contact fingers for plugging into openings along bus duct runs.



Capacitor Plug with front cover removed, exposing fusible disconnect switch and capacitor unit.

BULLDOG

ELECTRIC PRODUCTS CO.

Box 177, R. Pk. Annex, Detroit 32, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

MANUFACTURERS OF a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Circuit Breakers and BUStribution SYSTEMS.

Kellogg-American

The Kellogg Division

of

American Brake Shoe Company

announces the purchase of

Crown Spray Gun Manufacturing Company

Kellogg Division of American Brake Shoe Company has acquired the Crown Spray Gun Manufacturing Company of Los Angeles, California.

This adds to the Kellogg-American line of air compressors a complete range of spray equipment including guns, booths, exhaust fans and paint containers.

Kellogg also makes car lifts and high-speed car washers. With the purchase of Crown's production and research facilities, service in the fields where Kellogg-American is widely known and used will be expanded.

Products of the Crown plant, which will continue to be made at Los Angeles, will be distributed in the future under the name Kellogg-Crown. Each plant will benefit from the research and engineering divisions of both organizations, and from that of the American Brake Shoe group of technologists at Mahwah, New Jersey.

Kellogg Crown products and parts are available at

Crown Spray Gun Manufacturing Company, Los Angeles, California
Kellogg Division, Rochester, New York

AMERICAN Brake Shoe COMPANY

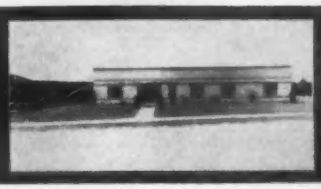
AMERICAN BRAKE SHOE COMPANY, 230 PARK AVE., NEW YORK 17, N. Y.

8 DIVISIONS, 59 PLANTS SERVING INDUSTRY AND TRANSPORTATION

American Brakeblok Division	Detroit, Mich.	Kellogg Division	Rochester, N. Y.
Ramapo Ajax Division	New York City	American Forge Division	Chicago, Ill.
American Manganese Steel Division	Chicago Heights, Ill.	Southern Wheel Division	New York City
Brake Shoe and Castings Division	New York City	National Bearing Metals Corp.	St. Louis, Mo.

VERSATILE PRODUCTION

Whether the job is Welding (Torch or Electric) . . . whether the job is Stamping, Coining, Forming, Drawing, or Annealing, the Metal Specialty Co. gives you years of versatile experience in Metal Working and Stamping. Specialists in Hydraulic cold drawing and embossing in all metals including stainless steel and aluminum. Deep drawing and embossing up to 850 tons capacity. Shells drawn up to 20" depth.



The
METAL SPECIALTY *Co.*
MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI, OHIO

ENGINEERING DATA FOR B-8 RELAY

Auto-Lite Type No. WSL-4001
Army Specification No. 32424A
Army Type — B-8 Current Relay (Starter Circuit)
Net Weight—1.25 pounds
Voltage—24 Volts DC
Current Rating — 1000 Amperes — Make, 250 Amperes Break
Relay picks up and seals at 7.5 Volts
Current Draw — At 24 Volts (cold) 3.8 Amperes
Vibration Test—Withstands up to 55 Cycles per second at 1/32" amplitude (1/16" total excursion)
Acceleration Test—Acceleration force of 10 G's does not cause malfunctioning
Altitude Test — Suitable from sea level up to above 35,000 feet
Ambient Temperature Range — 65°F. to + 160°F.

Again Auto-Lite proves it can lower cost and improve quality by applying precision engineering and mass production methods to aircraft parts manufacture.

This time the product is a 1000 ampere—24 volt intermittent duty relay suitable for use in all retracting motors, hydraulic pump motors, starters, propeller feathering installations and any other circuit of high amperage in which the duty is intermittent.

This relay, made the Auto-Lite way, cuts weight from the 2.35 pound specification to 1.25—more than a full pound! Contact life outperforms test requirements as much as 300 per cent! Performance range covers altitudes from sea level to over 35,000 feet and temperatures from *minus* 65 degrees F. to *plus* 160 degrees F.

Added to all this is the usual sharp saving in cost which so often follows when Auto-Lite's advanced thinking, engineering and manufacturing methods are combined with large scale production.

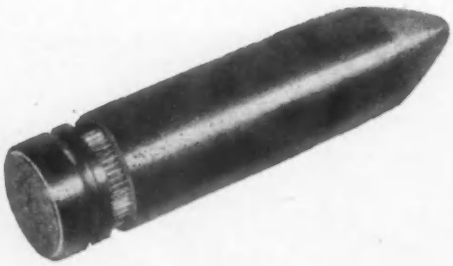
The relay offers special assurance of quality and reliability as every unit passes rigid U. S. Government inspection.

We have extra production capacity on these relays available to you now on proper priorities. Full information can be obtained by writing to

THE ELECTRIC AUTO-LITE COMPANY
SARNIA, ONTARIO TOLEDO, 1, OHIO

BUY WAR BONDS

AUTO-LITE



Want to make a million?

A million bullet cores or spark plug bodies—or a hundred million—each an exact duplicate of every other—

Acme-Gridley Automatics, Bar or Chucking, are ready to perform whenever industry needs large production of identical and interchangeable parts, of precise dimension and at low cost.

The same Acme-Gridleys that are now turning out parts for guns and planes and bullets will do an equally efficient job on peace products.

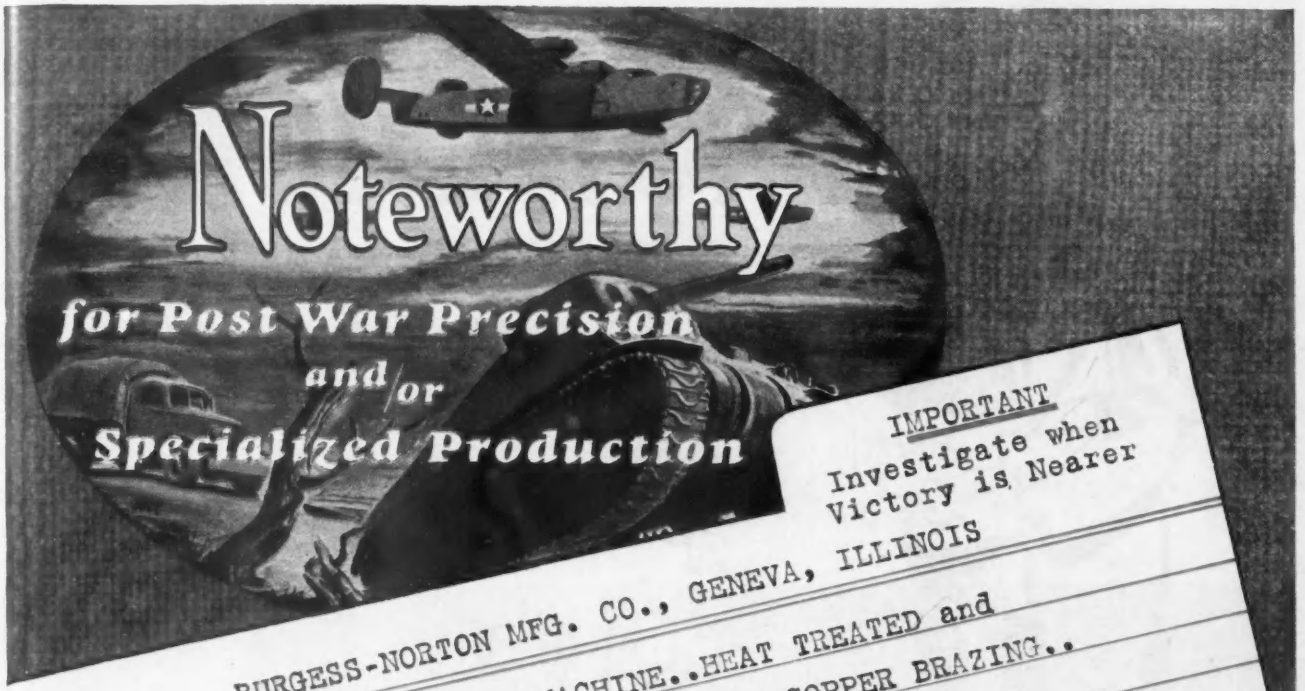
Usually retooling of these adaptable machines is simple and inexpensive, and can be done quickly.

When you are ready to retool—when your own machinists want help in getting new production started in a hurry—National Acme's corps of trained engineers—men who actually build Acme-Gridleys—will be glad to come and help you solve new problems.

The NATIONAL ACME *Company*

CLEVELAND · OHIO

ACME-GRIDLEY AUTOMATICS
maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.



Noteworthy

for Post War Precision and/or Specialized Production

IMPORTANT
Investigate when
Victory is Nearer

BURGESS-NORTON MFG. CO., GENEVA, ILLINOIS

PISTON PINS..SCREW MACHINE..HEAT TREATED and
GROUND STEEL PRODUCTS..HYDROGEN COPPER BRAZING..
NON-PRECISION BALL BEARINGS

This 40 year old metal working manufacturer really knows how to turn out precision production. Their war work includes accuracy to the nth degree..finishing to 2 micro inches..heat treating to the most exacting specifications ..and some mighty interesting developments in Hydrogen Copper Brazing that we may utilize to advantage. Have completely equipped metallurgical laboratories, engineering department..most modern testing equipment..largest Brazing furnaces in middle west..complete manufacturing facilities and men with the Know How.

A Part is never made right unless it is satisfactory to our customers.

ARMY NAVY

Burgess Norton
MANUFACTURING COMPANY
40 years in GENEVA, ILLINOIS

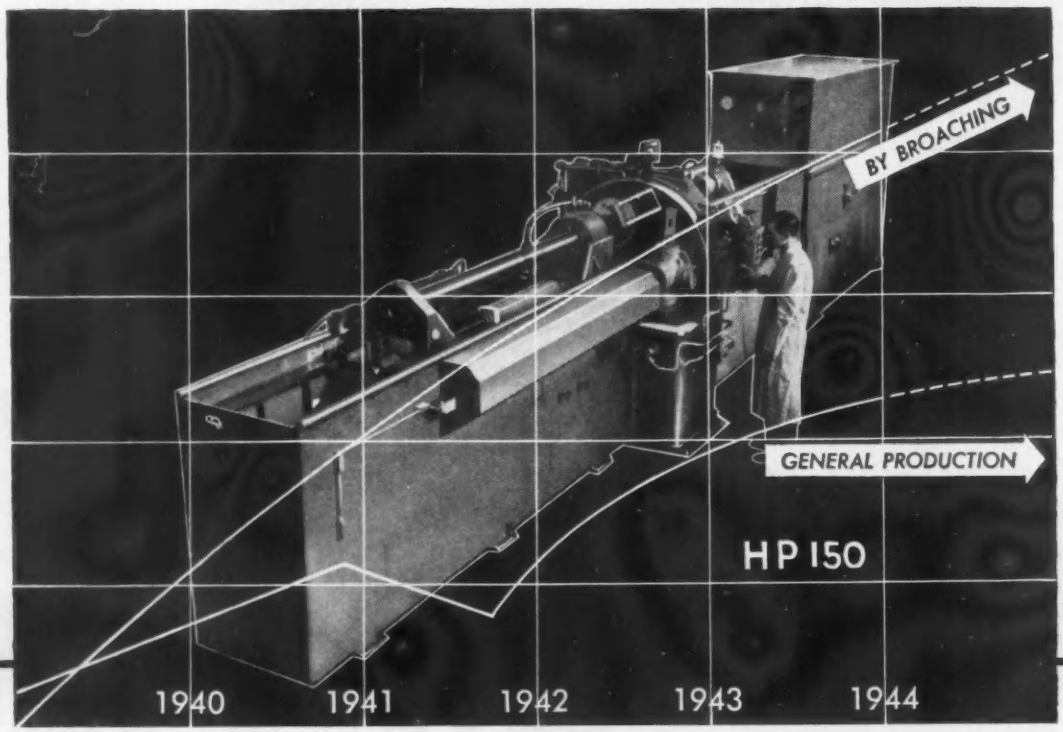
PROTECTION...

of Vital Production

of Vital Manpower

of Vital Time

BROACHING PRODUCTION FIGURES BASED ON ACTUAL SURVEY—



The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A

LONGER LIFE for fuel lines?

YOU GET IT IN TITEFLEX TUBING

Fuel lines don't have to be replaced every few thousand miles when Titeflex is used.

• Flexible, durable and non-corrodible—this all-metal tubing withstands vibration, engine heat, and the disintegrating action of oils and gases—the 3 most powerful agents of destruction in automotive equipment.

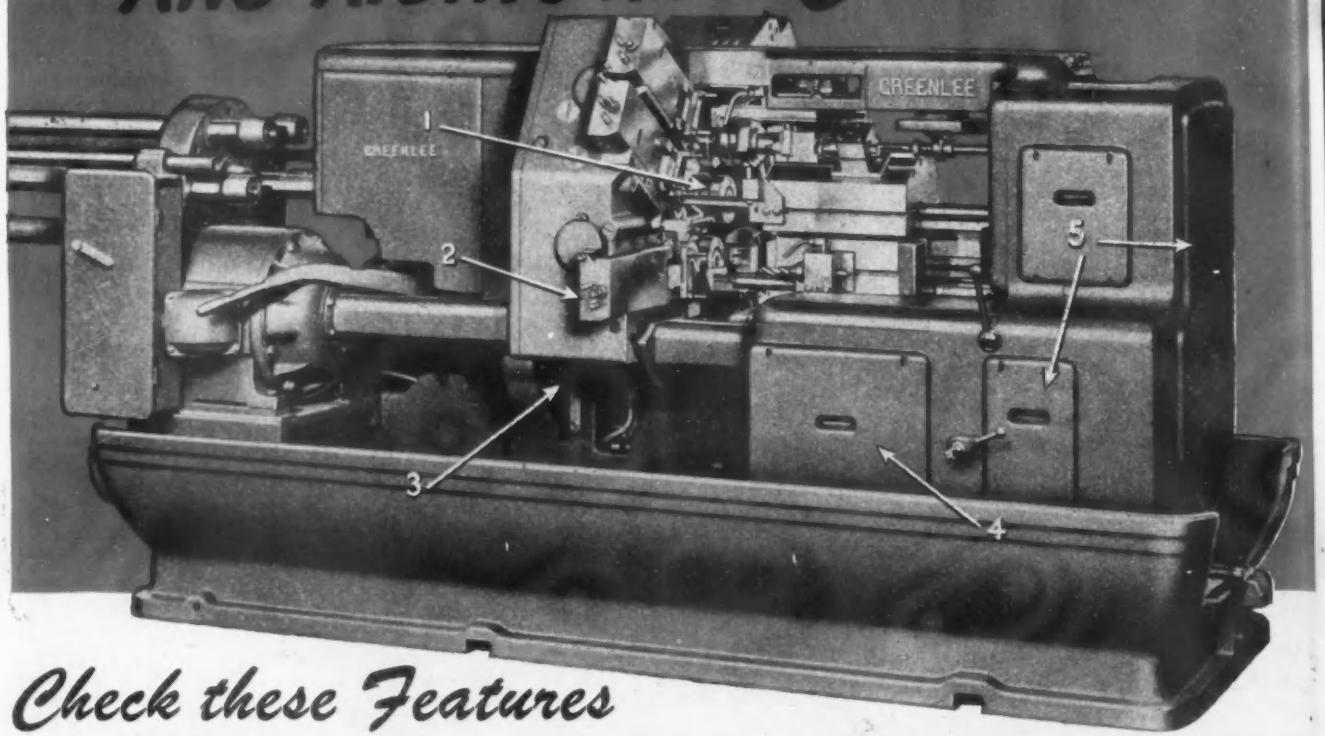
• Today, of course, Titeflex is important equipment on vehicles of war.

• *But, the automotive industry is now preparing for post-war production . . .*

• Our research staff is already planning new and broader applications of Titeflex for the automobile and truck industry. Design engineers are invited to discuss these new developments and learn the advantages Titeflex will offer as efficient, economical oil, gas and air lines in the improved automotive equipment of tomorrow.

• THE TITEFLEX METAL HOSE CO. •
507 FRELINGHUYSEN AVENUE • NEWARK 5, N. J.

SAVING TIME FOR SET-UP MEN — AND AIDING NEW OPERATORS

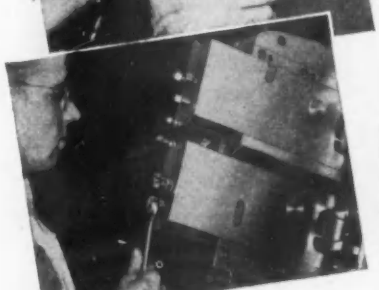


Check these Features

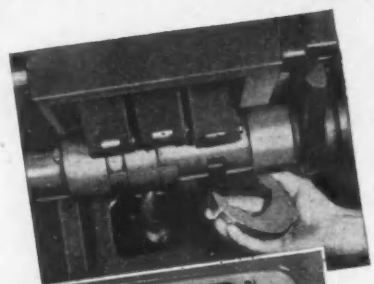
GREENLEE 6-SPINDLE AUTOMATICS

Advantages of accuracy and 6-spindle speed, plus adaptability of machine to efficient war or peacetime production problems, are important factors in the popularity of Greenlee Automatics. The wide-open tooling area and simple adjustments are important time savers for set-up men — important, too, in today's training program for new operators.

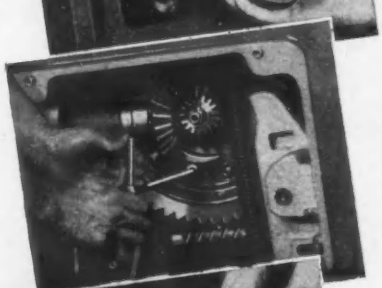
1 ***Collet feature promotes accuracy and saves time*** ... collets close positively on bar fed out to stock-stop. There's no endwise movement of collets, none transmitted to stock, promoting accuracy in length of piece.



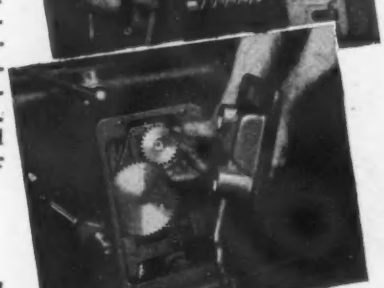
2 ***Cross-Slide tool adjustments quick and easy*** ... rigid forged-steel cross-slides have identical tool-cavities. Precision adjustments are simple ... easy to understand. The three fine-thread screws move tool holder in desired direction.



3 ***Simple Cross-Slide camming*** ... cross-slides operate independently, permit better tooling set-ups ... increase production. Cams are interchangeable and eliminate special camming for each job.



4 ***No camming required on Main Tool Slide*** ... adjustments are made in jiffy. Adjustable dog on a graduated worm wheel provides exact settings for tool slide stroke. Scales on tool slide help check stroke.



5 ***Speeds and feeds for production and economy*** ... multi-splined pick-off gears provide wide range of speeds and feeds. Machine, with 1⅝" capacity, has spindle speed range from 105 to 2625 R. P. M. and feed range of .0017 to .0388 per spindle revolution.

GREENLEE BROS. & CO.
1751 MASON AVENUE, ROCKFORD, ILLINOIS

GREENLEE *Automatic Screw Machines*

MAHON *Hydro-Flo* INDUSTRIAL WASHING MACHINES

FULL COVERAGE-3 WAYS

FULL COVERAGE CLEANING... Any part or product—regardless of size, shape or irregularity of surface—can be thoroughly cleaned in a Mahon Hydro-Flo Washing Machine. With the Hydro-Flo method, the cleaning solution is directed against the part to be cleaned in a series of jets or sprays, so adjusted as to strike the part from every possible angle—top, sides and bottom. This complete cleaning action insures an absolutely clean metal surface for the reception of paint or other finishing processes.

FULL COVERAGE OF OPERATING MECHANISM... All working parts — conveyors, pumps, sprays, solution tonks and piping—are enclosed in a cabinet of modern design, yet are quickly and easily available through ample openings that permit access without cramping. Any type of conveyor may be incorporated—overhead, floor, slat-belt or mesh-apron—whichever is most suitable. Operation of all mechanisms is entirely automatic.

FULL COVERAGE OF SIZES AND TYPES... Each Mahon Hydro-Flo Washing Machine is individually designed and built around the part to be cleaned—there are no *standard* types or sizes. Mahon engineers carefully study the job to be done and then develop a machine to exactly fit your purpose and your finishing production line—a machine you can safely rely upon for fast, efficient service—at a saving.

THE R. C. MAHON COMPANY

DETROIT — CHICAGO

Designers and Manufacturers of Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Systems, Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—Including Complete Finishing Systems.

MADE TO THE CLOSE TOLERANCES SET BY THE AVIATION INDUSTRY
UNBRAKO
Reg. U.
INTERNAL WRENCHING SOCKET BOLTS
The high degree of precision demanded by the aviation industry is fully met by "Unbrako" Internal Wrenching Socket Bolts. They are being manufactured in our largest department where equipment is of the finest and workers are highly skilled and experienced in making precision aircraft engine parts. These bolts have the famous "Unbrako" qualities of strength and accuracy while due to their internal wrenching feature they facilitate compact designs and save thereby material, weight and cost.
The new "Unbrako" 100° Flush-Head Socket Bolts, unlike ordinary [illegible] are made to most extreme accuracy.

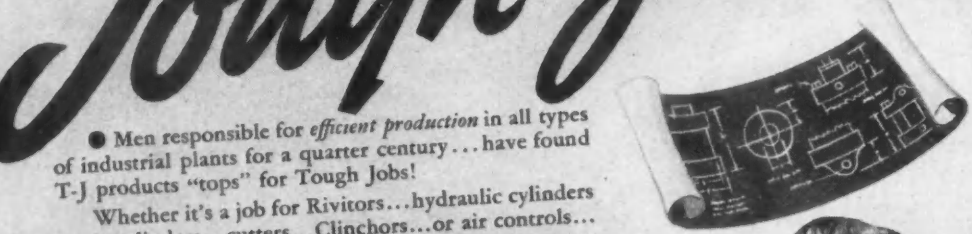
FOR ACCURACY
. . . FOR STRENGTH
. . . FOR SAFETY
Knurled "Unbrako" Socket Head Cap Screws
The knurled heads prevent time-wasting finger slip and lost motion—help speed production. Knurling also permits locking after countersinking. Sizes: No. 4 to 1½" diameter.
"UNBRAKO" Self-Locking Hollow Set Screws with the Knurled Points
Maintenance, time and money savers. When tightened as usual, the knurls dig in and lock the screws in place so they positively won't work loose under vibration. Sizes: No. 4 to 1½" diameter.
PAT'D and PAT'S PENDING
"UNBRAKO" Knurled Socket Head Shoulder Screws
are precision ground . . . are extensively used in many places. Great variety of sizes immediately available from stock.
STANDARD PRESSED STEEL COMPANY
BOX 611 JENKINTOWN, PENNSYLVANIA
BOSTON · DETROIT · CHICAGO · ST. LOUIS · INDIANAPOLIS · SAN FRANCISCO
OVER 40 YEARS IN BUSINESS
Knurling of socket screws originated with "Unbrako" years ago.

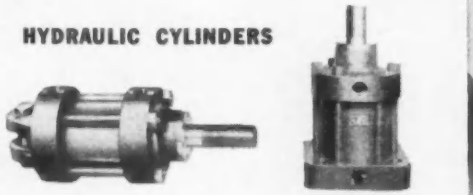
PLAN FOR TODAY AND TOMORROW WITH T-J FOR *Tough Jobs!*

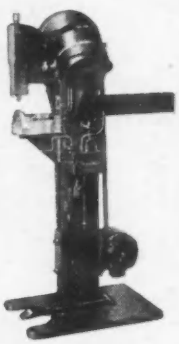
● Men responsible for *efficient production* in all types of industrial plants for a quarter century... have found T-J products "tops" for Tough Jobs!

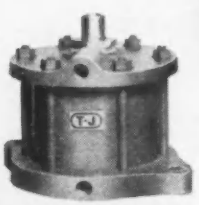
Whether it's a job for Rivitors... hydraulic cylinders ...air cylinders... cutters... Clinchors... or air controls... you can count on T-J for unbeatable efficiency, accuracy and dependable performance! All T-J products built to precise standards of manufacture... rigidly inspected... backed by practical-minded experienced engineering. In planning a better production set-up for better products... specify T-J Quality! Write for bulletins.

The Tomkins-Johnson Co., Jackson, Mich.









T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

Alert Eyes Scan the Skies!

The spectacular development and expansion of the wartime Aircraft Industry in this country has been little short of a miracle. Thousands upon thousands of Allied war planes are putting increasingly terrific pressure on the enemy.

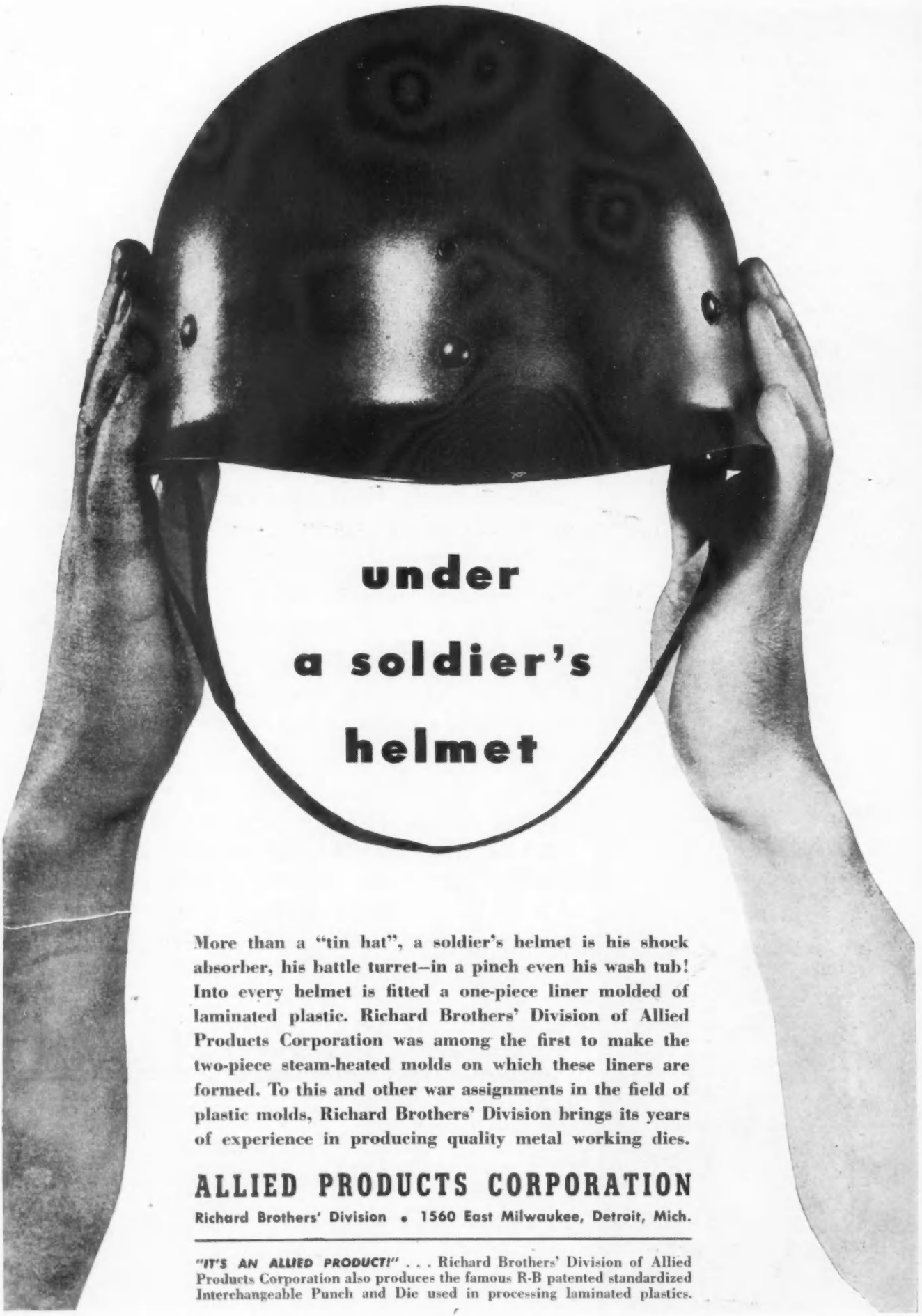
But alert eyes still scan the skies. They vision, after the war, a world of plane traffic. Passengers and cargoes will be flown to all parts of the world.

To that ultimate end FENN AIRCRAFT was organized . . . to serve the plane and engine builder now and after the war.

Fenn Aircraft is specializing in the manufacture of precision-built plane and engine parts. Many of these parts are subassembled into complete components, all ready for the assembly line. Careful coordination of production with the needs and specifications of the aircraft builder features the subcontracting service of Fenn Aircraft.

Fenn Aircraft **NEW BRITAIN CONNECTICUT**

DIVISION OF FENN MANUFACTURING COMPANY
MANUFACTURERS OF AIRCRAFT SUBASSEMBLIES AND PARTS



under a soldier's helmet

More than a "tin hat", a soldier's helmet is his shock absorber, his battle turret—in a pinch even his wash tub! Into every helmet is fitted a one-piece liner molded of laminated plastic. Richard Brothers' Division of Allied Products Corporation was among the first to make the two-piece steam-heated molds on which these liners are formed. To this and other war assignments in the field of plastic molds, Richard Brothers' Division brings its years of experience in producing quality metal working dies.

ALLIED PRODUCTS CORPORATION

Richard Brothers' Division • 1560 East Milwaukee, Detroit, Mich.

"IT'S AN ALLIED PRODUCT!" **. . . Richard Brothers' Division of Allied Products Corporation also produces the famous R-B patented standardized Interchangeable Punch and Die used in processing laminated plastics.**

I am a CLARK FORK TRUCK

A Product of **CLARK EQUIPMENT COMPANY**

I work 24 hours a day, at home or overseas . . . wherever free men are fighting. I am always behind the lines handling the supplies that keep them fighting.

Our fighting men need all the supplies I handle now . . . I am working full time with our armed-forces to speed Victory.

But, I haven't forgotten the job I am able to do at home.

You can get me to work for you . . . thousands more of my family (we have over 60 members) will soon be available to feed your production lines . . . to save time — to save manpower — to lower costs, that more of your products, whatever they may be, will be available sooner, because I handle everything from the raw to the finished products.

I can work in the factory, yards, warehouse or on the docks.

I handle loads of 1000 to 7000 lbs. like they are as light as ducks' down.

The men and women who control me never know fatigue. . . . I do the work. At the slightest urging I am on my way, looking for material to carry, stack or tier. I save plenty of floor space too, by stacking material to the ceiling, and you should see how easy I do it.

Don't forget, like I told you, as soon as I can, when more like me are available, I'll be ready to help you. I'm tough and rough and a glutton for work.

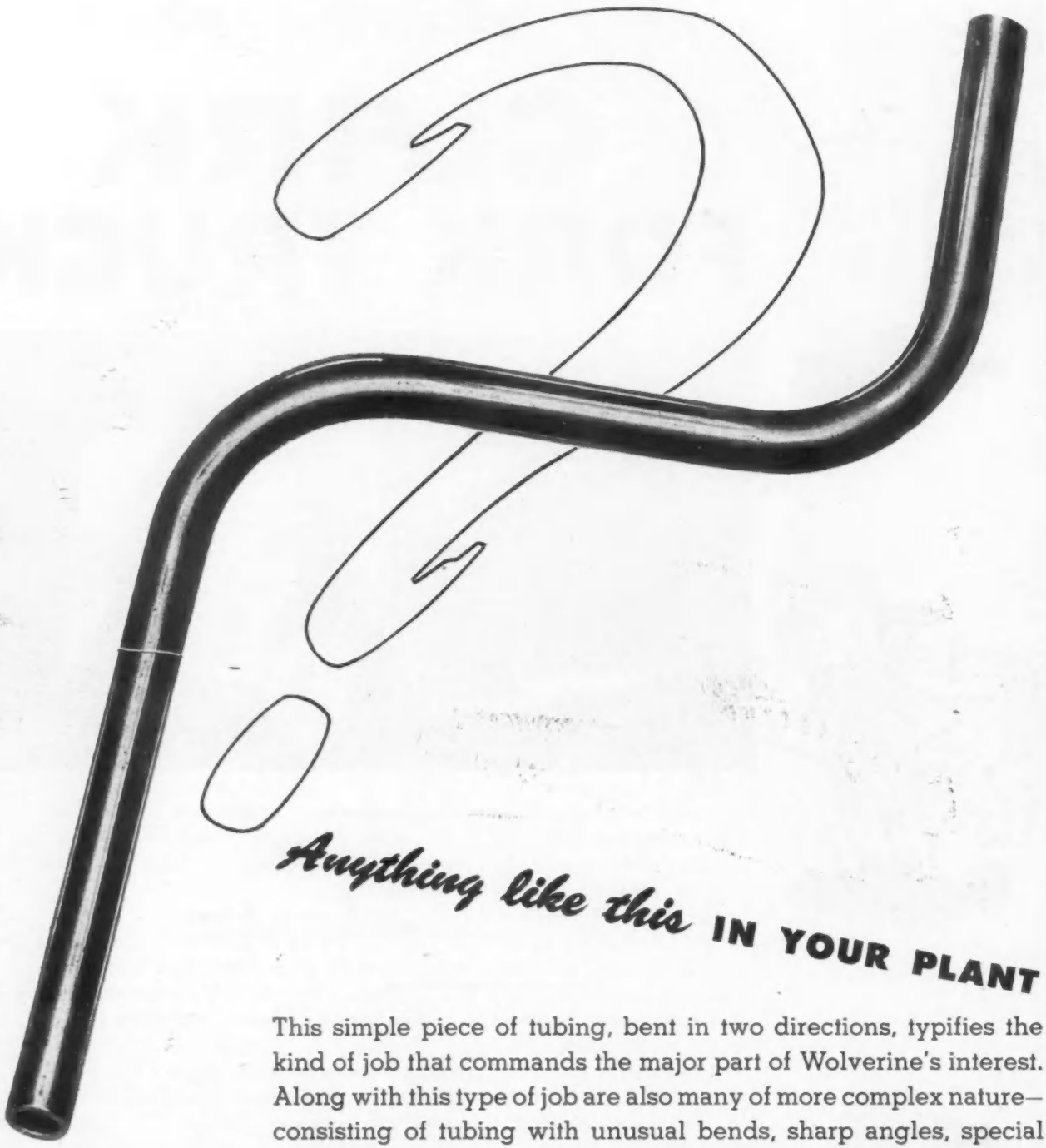
Sincerely, *Clark Fork Truck*

P. S. I was built by the Men of Clark and they are a fine lot of Craftsmen.

CLARK TRUCTRACTOR

DIVISION OF CLARK EQUIPMENT COMPANY

BATTLE CREEK, MICHIGAN, U.S.A.



ACTUAL SIZE

Anything like this IN YOUR PLANT

This simple piece of tubing, bent in two directions, typifies the kind of job that commands the major part of Wolverine's interest. Along with this type of job are also many of more complex nature—consisting of tubing with unusual bends, sharp angles, special ends and fittings, etc., brought to us because of our specialized knowledge and experience in handling seamless tube.

If you use copper or brass tube or tubular parts, let us furnish them, whether you ask us to do the fabricating to your specification or you do it yourself.

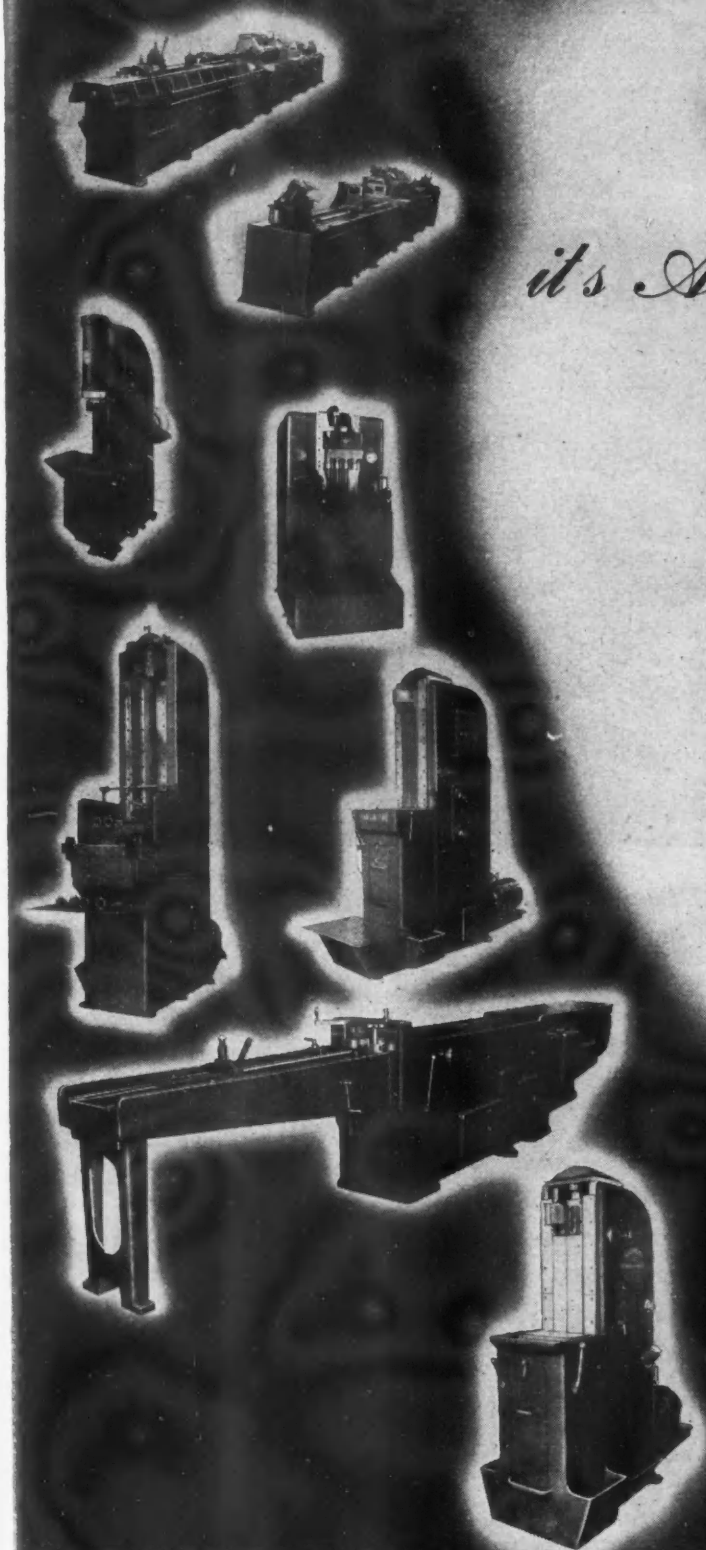
WOLVERINE
TUBE DIVISION

CALUMET & HECLA CONSOLIDATED COPPER COMPANY

417 CENTRAL AVENUE, DETROIT 9, MICHIGAN • In Canada: UNIFIN TUBE CO., LONDON, ONT.

THIS AIRCRAFT ENGINE PLANT ...MINATES

it's All-American Team



So high is the production-with-precision obtained by broaching that one machine is ample for most metal working plants. Few have as many as 10 or 15.

Consider, therefore, the importance of this particular aircraft engine plant in the broaching picture, with 91 American machines!

Their personnel *knows* broaching. They know the value of dealing with an old-line company whose principals have been identified with broaching since the turn of the century. They know, too, the importance of a *complete* broaching service—machines, tools, and engineering — for winning war production, profitable post-war production.

Significant is this overwhelming vote of confidence in American Broach equipment.

BROACHING IS BETTER THE *American* WAY

American

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

PAGE *Welding* ELECTRODES

WELDING STAINLESS?

Then you know how important it is that the metal deposited in the weld shall equal the Stainless you are welding. **PAGE** took away all uncertainty in that regard when they, in cooperation with the largest manufacturers of Stainless Steel, produced a complete range of **PAGE-ALLEGHENY STAINLESS STEEL ELECTRODES**—a range so complete that from it you can select the exact electrode for your work.

★ ★ ★

Because Stainless Steel stands so high on the list of critical materials, it is more than ever necessary to see to it that the electrode you are able to get will give you the proper metal in the weld. And it becomes even more essential to see that you get electrodes of the proper diameter and that your men waste none of them.

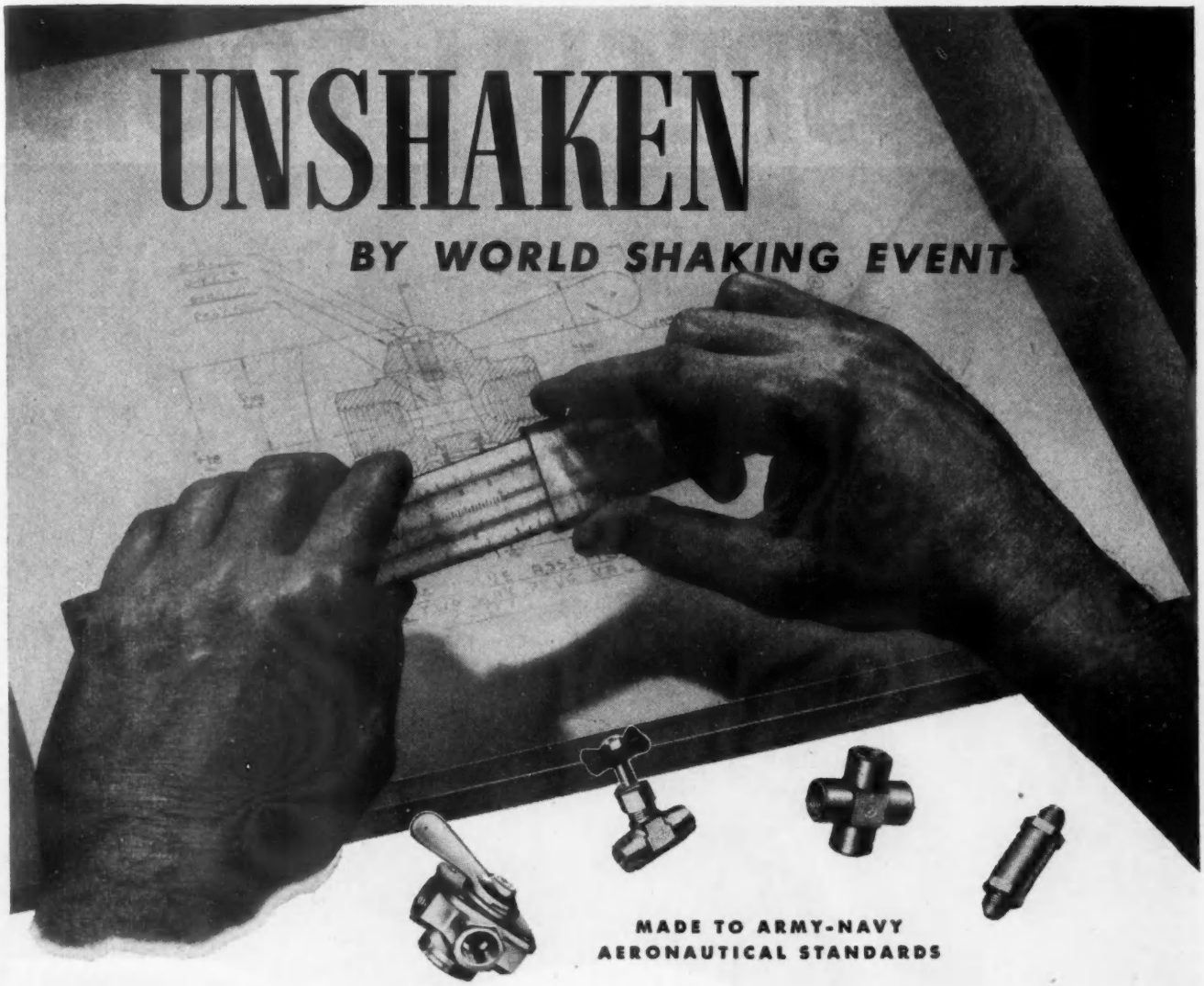
PAGE STEEL AND WIRE DIVISION

Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York, Pittsburgh, San Francisco, Portland

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

ESSENTIAL PRODUCTS . . . TRU-LAY Aircraft, Automotive, and Industrial Controls, TRU-LOC Aircraft Terminals, AMERICAN CABLE Wire Rope, TRU-STOP Brakes, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Castings, CAMPBELL Cutting Machines, FORD Hoists, Trolleys, HAZARD Wire Rope, Yacht Rigging, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*



● The men who design and calculate and transmit blue-prints into shipments of war materials must be steady. The shocks of battle have their effect all the way back along the line to the factories. Even in the most isolated plant there must be no "hurried" engineering, no slighted inspections, no variation outside the narrow tolerances of precision manufacture.

The Dole Valve Company rose to the supercharged level of war production with a sound staff of engineers—in an area where the right skills can be hired and held by fair treatment—in a location where it is especially practical to assemble and fabricate materials for shipment wherever needed.

All of these factors will be as useful after the war, as they are urgent now.

DOLE

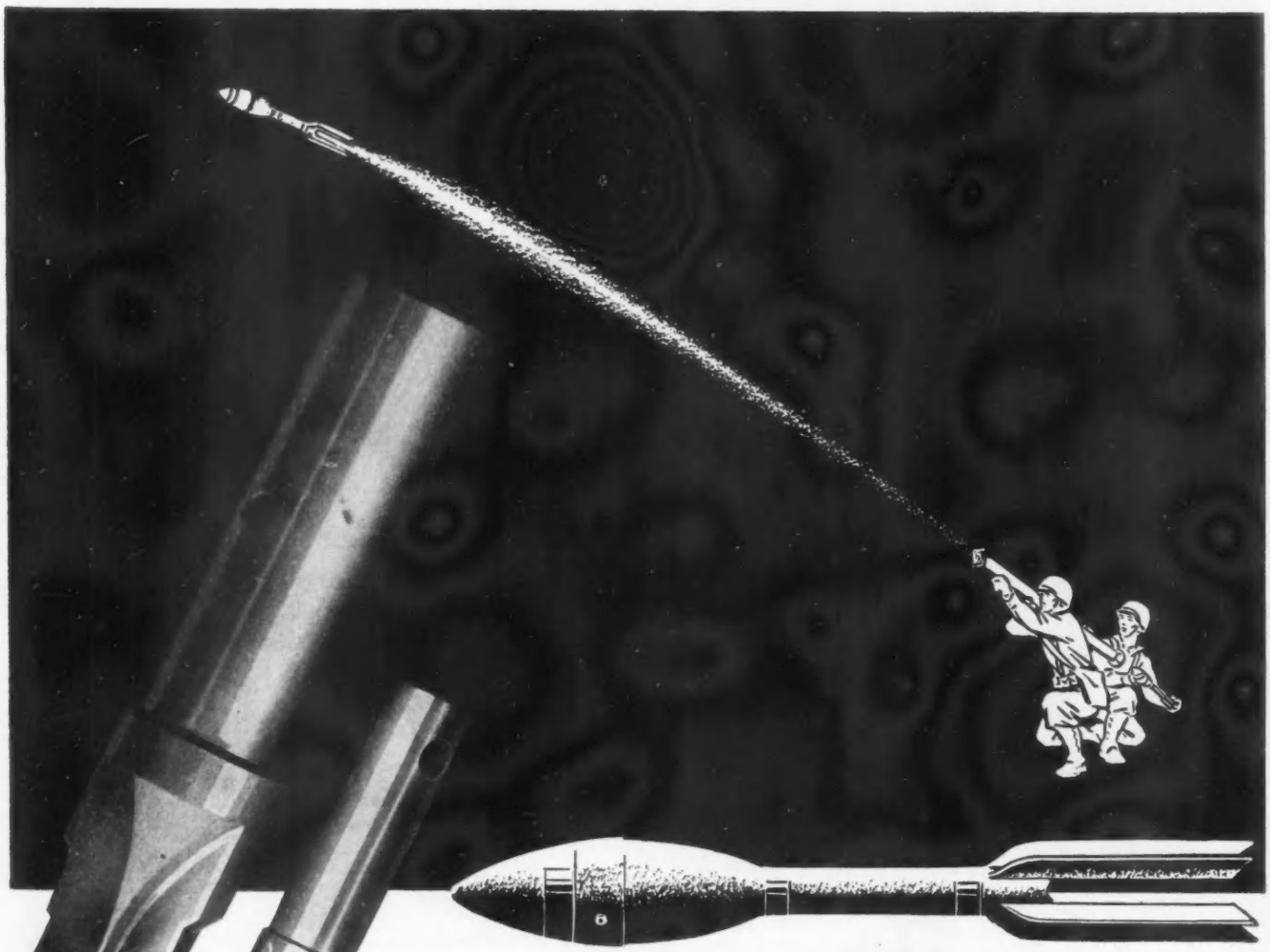
THE DOLE VALVE COMPANY
ESTABLISHED 1906
1901-1941 Carroll Avenue, Chicago 12, Illinois
LOS ANGELES • DETROIT • PHILADELPHIA

★

BUY U. S. WAR BONDS AND STAMPS

AIRCRAFT VALVES AND FITTINGS

These SPECIAL TOOLS



developed for the manufacture of

BAZOOKA PROJECTILES

Just one of many instances where MOTOR TOOL *designing and production facilities* have been utilized in turning out intricate SPECIAL TOOLS required in the producing of essential war materiel.

Whatever YOUR requirement—however unusual the cutting operation—you can be sure of getting the precise tool you need if it is . . .

REFINED AND PRODUCED *by*

MOTOR TOOL MANUFACTURING CO.

METAL CUTTING TOOLS

7775 CORTLAND AVENUE · DETROIT, MICHIGAN

"Make it a Rule to Call Motor Tool"

FELT *Facilitates*

YOUR "OVERTIME" PLANNING FOR *V-Day* PRODUCTION

American inventive genius cannot be grounded by war clouds! So, late at night many a solitary figure leans intent over a drafting board, as a trained mind directs deft fingers in the creation of . . . an idea . . . for current or post-war application. Contributing much to such designs are the new uses for materials, principles and improved techniques, developed in the crucible of war.

Outstanding among the basic materials whose countless new applications have passed the most rigid wartime tests is FELT. Successfully replacing many more costly materials, FELT figures high in designing for more efficient and economical lubrication, filtration and insulation . . . to name just three of FELT'S scores of important functions.

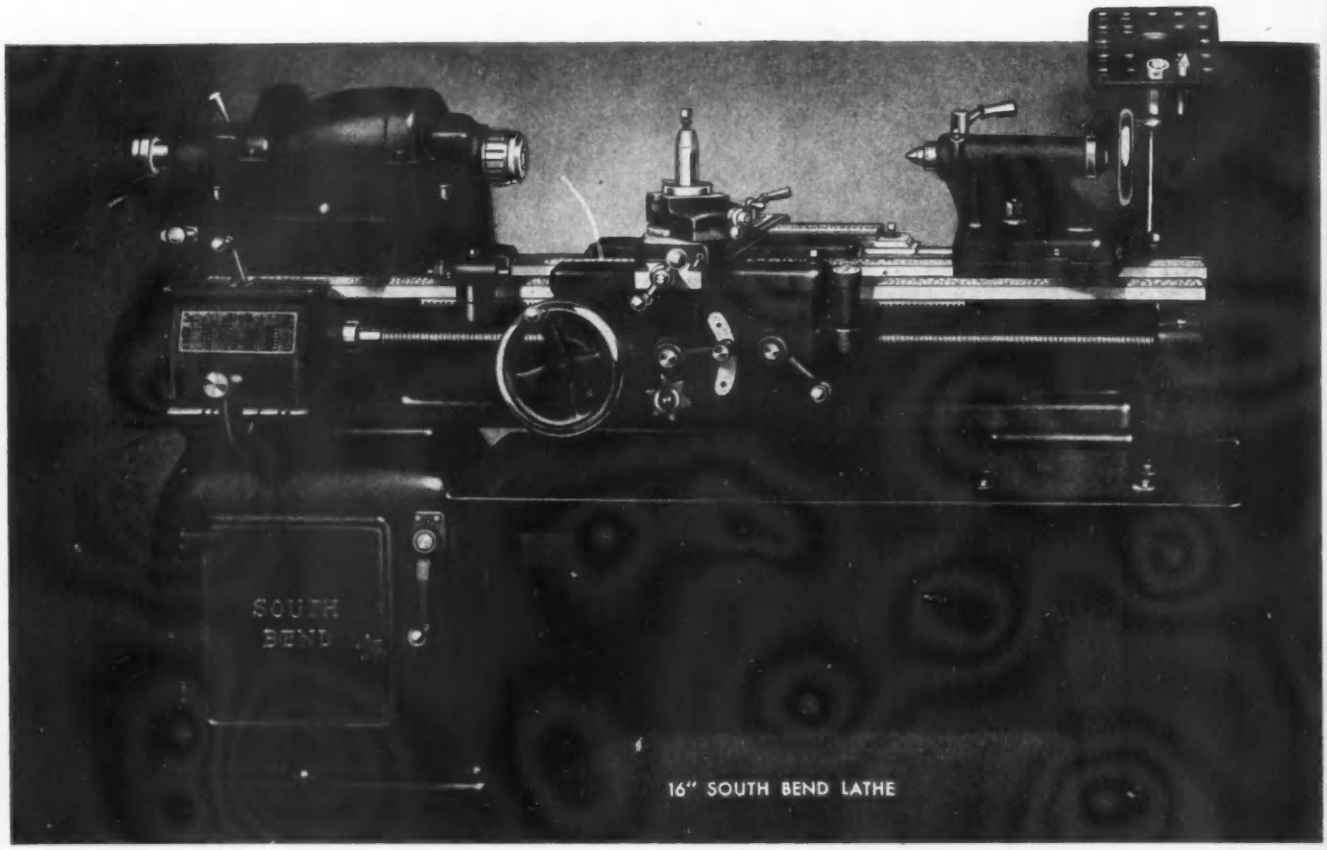
As the leading FELT manufacturer and producer of cut FELT parts for the automotive and aviation industries, we are in a position to be of material assistance. Our wealth of experience and first-hand knowledge of advances in FELT technology are at your instant command. . . . Simply ask to see an American Felt Company Engineer. With "overtime" planning, *as in war work*, we seek to share by helping *wherever* and *whenever* we can!

American Felt Company
TRADE MARK

General Offices: GLENVILLE, CONN.

Sales Offices at New York, Boston, Chicago, Detroit, Philadelphia, Cleveland, St. Louis, San Francisco, Dallas, Seattle, Los Angeles

PRODUCERS OF FINEST QUALITY FELT PARTS FOR OIL RETAINERS, WICKS, GREASE RETAINERS, DUST EXCLUDERS, GASKETS, PACKING, VIBRATION ISOLATION, INSULATION AND SOUND ABSORPTION FELTS



16" SOUTH BEND LATHE

SOUTH BEND LATHES

FOR UNIFORM ACCURACY

SPECIFICATIONS of 16" lathe

Swing over bed	16¼"
Distance between centers	33½"
Maximum collet capacity	1"
Hole through spindle	1⅜"
Thread cutting feeds (48)	4 to 224 per inch
Spindle speeds (8)	21 to 725 r. p. m.
Power longitudinal and cross feeds	48

BUY WAR BONDS

WAR PRODUCTION demands uniform accuracy. The loss of time or the waste of scarce strategic materials because of variations in machining cannot be tolerated. There is no place in our war production plan for equipment that cannot be relied upon to maintain the required tolerances.

Sound design and careful workmanship give South Bend Lathes the dependable precision that assures uniform accuracy at all times and speeds-up production on the most exacting machining operations.

South Bend Engine Lathes and Toolroom Lathes are made with 9", 10", 13", 14½", and 16" swings, with bed lengths from 3' to 12'. The Turret Lathes are made with 9" and 10" swings. Write for Catalog No. 100-C in which they are all described and illustrated.

TRAINING HELPS — Sound films, books, wall charts, and bulletins are available for training lathe operators. Write for Bulletin No. 21-C.

SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 37 YEARS • SOUTH BEND 22, IND.

The Eye That Must Be Steady!

When the eyes of America's war birds are turned to earth to see how deep the bite of the bomber has been, to search out the target for tonight, there must be no wavering. Precision-built camera mounts by Guiberson are serving to direct and hold unmoving the eye that searches out the target. Care and precision in manufacture are the heritage of every Guiberson-built aircraft part.

BETTER BE SAFE THAN SORRY — GUIBERSON

ESTABLISHED 1919

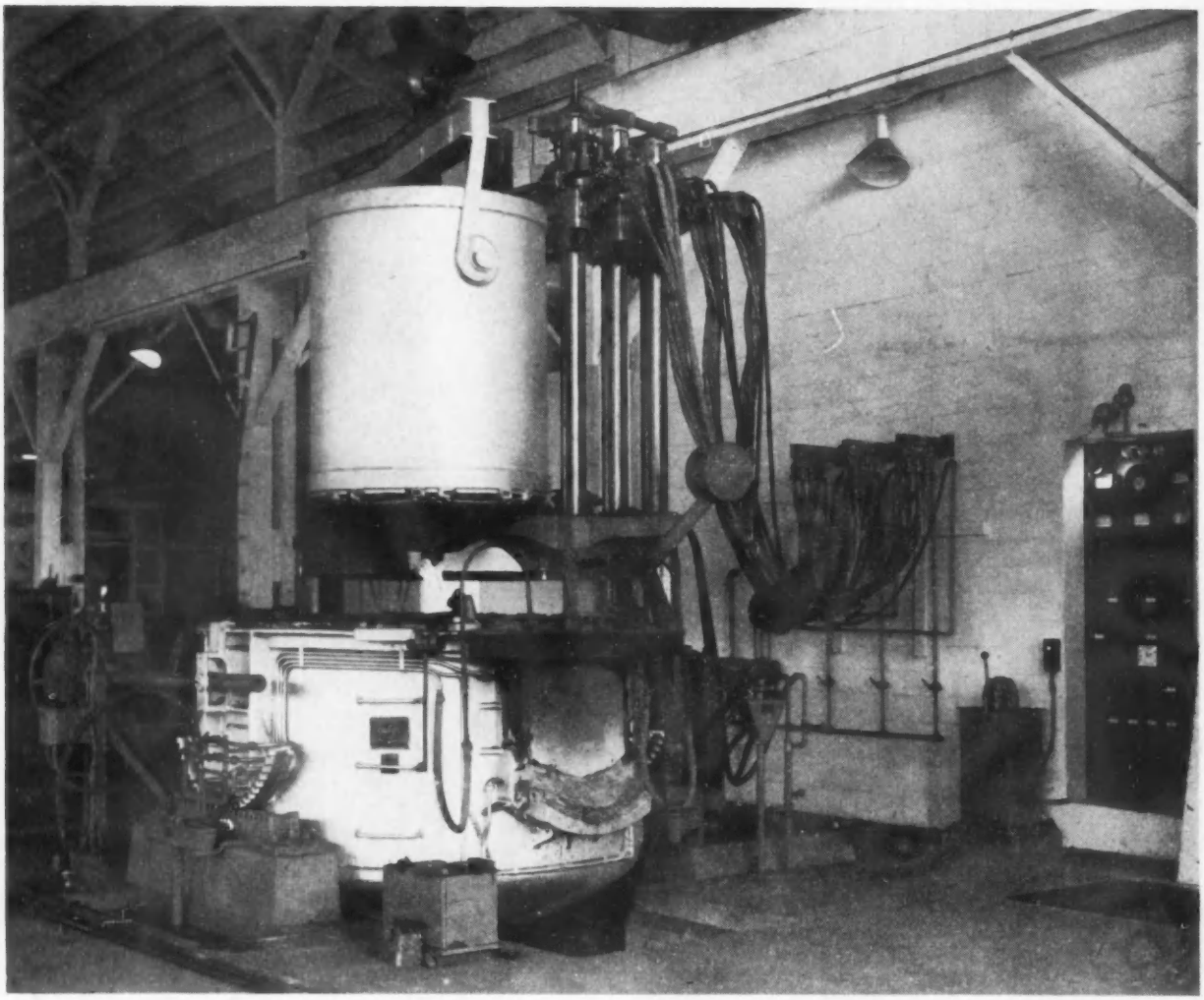
AMERICA'S ONLY RADIAL AIR-COOLED DIESEL ENGINE BUILT BY GUIBERSON

Guiberson PRECISION BUILT

- ★ Drop hammer parts of all kinds
- ★ Sheet metal assemblies
- ★ Flap track supports
- ★ Fire walls
- ★ Auxiliary seats
- ★ Navigating seats
- ★ Motor mounts
- ★ Sumps
- ★ Cowling parts and assemblies
- ★ Exhaust manifolds
- ★ Intake manifolds
- ★ Inter-cylinder baffles
- ★ Gun windows or doublers
- ★ Gun nose boxes
- ★ Camera windows
- ★ Scoops
- ★ Ducts
- ★ High altitude heating systems
- ★ Gasoline tanks
- ★ Hydraulic reservoirs
- ★ Collector rings
- ★ Camera mounts

Guiberson U.S.A.

THE GUIBERSON CORPORATION
GUIBERSON DIESEL ENGINE COMPANY
DALLAS, TEXAS



FOR SPEED and elimination of waste

LECTROMELT furnaces of the top charge type are producing increased tonnages of steel and iron. The top charge feature results in lower man hours per ton, minimum loss of time between heats, and lower operating costs. Open, bulky scrap can readily be charged.

LECTROMELT iron furnaces are producing high strength gray iron by batch melting or by duplexing cupola metal. LECTROMELT furnaces are designed for efficient operation and are ruggedly built to give long, hard foundry and steel mill service. Furnaces available in capacities from 100 tons to 250 pounds.

MOORE RAPID
Lectromelt
FURNACES

Pittsburgh Lectromelt Furnace Corporation
Pittsburgh, Pennsylvania

The Furnace of Today and Tomorrow

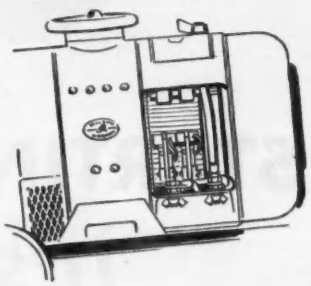
Protect the *Service Value* of your WILSON WELDER

FOLLOW THESE GOOD MAINTENANCE PRACTICES

1 Keep every welding machine protected when it's not in use. Don't, however, cover the machine when running—it needs ventilation.

2 Don't overload your machine. For instance, do not use the machine continuously above its rated capacity. This causes overheating and charred insulation.

3 Be sure that bearings are properly greased. Refer to manufacturer's operating instructions for correct procedure and recommended lubricants.



4 Check all connections regularly to insure perfect contact. Loose connections may cause erratic operation.

5 Check brushes of D. C. machines periodically to be sure they make proper contact with the commutator.

send for FREE Maintenance Booklet

Our new free booklet, "Maintenance Instructions for Wilson Arc Welders," will help you keep welding machines in good working order. We'll be glad to send you as many copies as you need.

BUY UNITED STATES WAR BONDS

AIRCO WILSON

AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.

In Texas: MAGNOLIA AIRCO GAS PRODUCTS CO. • General Offices: HOUSTON, TEXAS

FA

AIR REDUCTION, Advertising Department
60 East 42nd Street, New York 17, N. Y.

Please send me_____copies of the free booklet "Maintenance Instructions for Wilson Arc Welders."

*Name*_____

*Company*_____

*Address*_____

STARTING JANUARY 18TH

IT'S UP TO YOU!

STARTING January 18th, it's up to you to lead the men and women working in your plant to do themselves proud by helping to put over the 4th War Loan.

Your Government picks you for this job because you are better fitted than anyone else to know what your employees can and should do—and you're their natural leader. This time, your Government asks your plant to meet a definite quota—and to break it, *plenty!*

If your plant quota has not yet been set, get in touch now with your State Chairman of the War Finance Committee.

To meet your plant quota, will mean that you will have to hold your present Pay-Roll Deduction Plan payments at their peak figure—*and then get at least an average of one EXTRA $100 bond from every worker!*

That's where your leadership comes in—and the leadership of every one of your associates, from plant superintendent to foreman! It's your job to see that your fellow workers are sold the finest investment in the world. To see that they buy their share of tomorrow—of Victory!

That won't prove difficult, if you organize for it. Set up your own campaign right now—and don't aim for anything less than a 100% record in those *extra* $100 bonds!

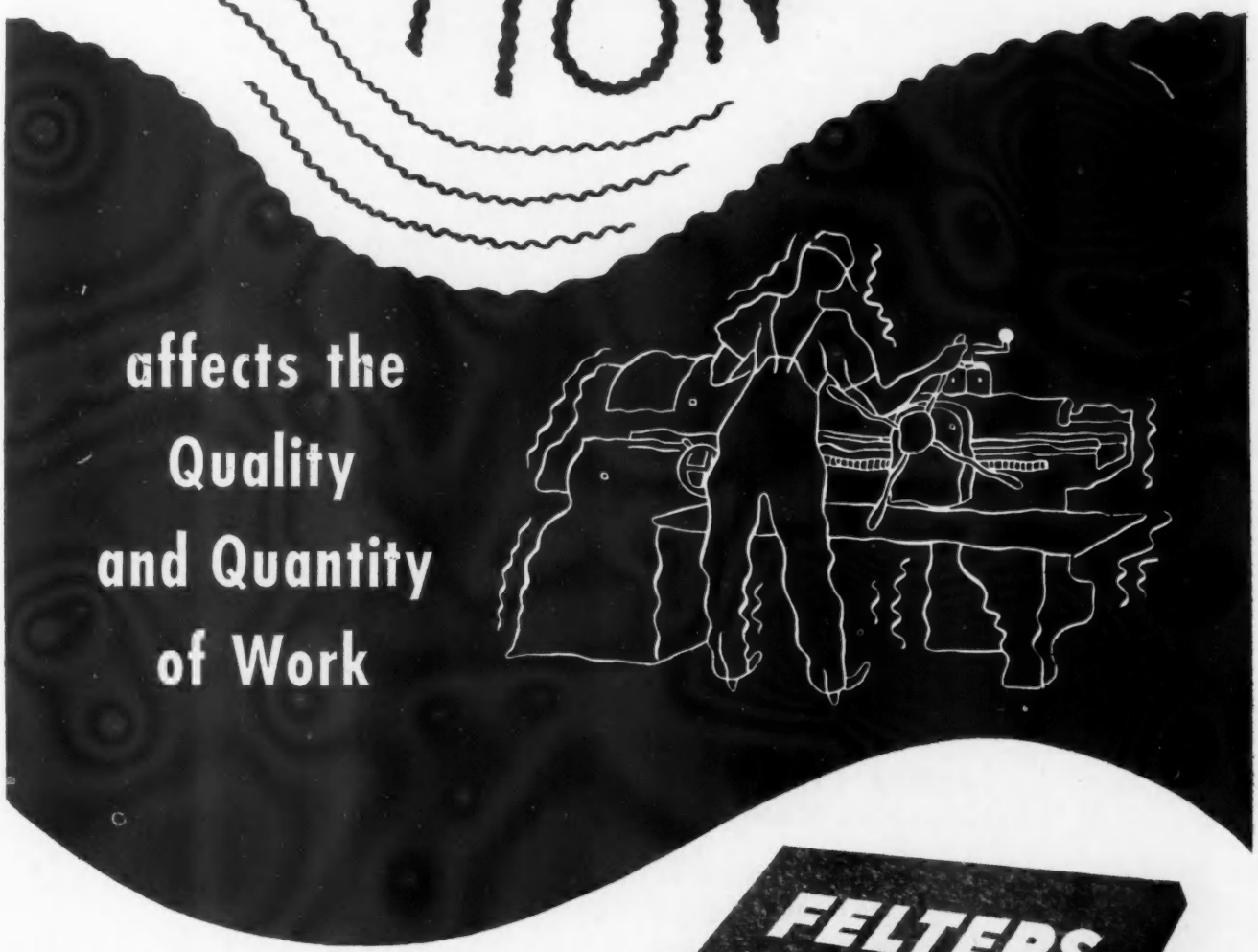
And here's one last thought. Forget you ever heard of "10%" as a measure of a reasonable investment in War Bonds under the Pay-Roll Deduction Plan. Today, thousands of families that formerly depended upon a single wage earner now enjoy the earnings of several. In such cases, 10% or 15% represents but a paltry fraction of an investment which should reach 25%, 50%, or more!

Now then—Up and At Them!

Keep Backing the Attack!—WITH WAR BONDS

This advertisement prepared under the auspices of the United States Treasury Department and the War Advertising Council

VIBRATION



affects the Quality and Quantity of Work

...ISOLATE IT WITH

Because vibration is often considered an inescapable part of a machine's operation, too often nothing is done to cut down the bad effects of this vibration. These bad effects are: a poorer quality of work, reduced output, increased wear and repair of machines and floors, decreased operator efficiency.

But fortunately, as many companies know, *machine vibration can be isolated and dampened with Felters Unisorb—in a short time and at small cost*. And the savings from using Unisorb for this purpose are big . . . and quick.

Send for the Felters Booklet "Unisorb in the Industrial Plant." It contains charts, tables and greater details of the advantages of using Unisorb.

THE **Felters Company**

210-R SOUTH STREET • BOSTON, MASSACHUSETTS

Offices: New York, Philadelphia, Chicago, Detroit

Sales Representatives: Dallas, Los Angeles, Nashville, St. Louis, St. Paul • Mills: Johnson City, New York; Millbury, Massachusetts; Jackson, Michigan

Readers' Choice!

AUTOMOTIVE and Aviation INDUSTRIES has no subscription salesmen —yet it has 40,000 readers.

Its subscription renewal percentage is by far the highest in its field, and one of the highest, if not the highest among business magazines.

Its subscribers renew, for the most part, upon presentation of a renewal bill by mail—or a reminder, likewise by mail.

Also, a little more than 4 automotive or aviation men read every paid-for plant copy.

Any publication selected by its readers—not sold to them—automatically has the highest degree of reader interest, as has AUTOMOTIVE and Aviation INDUSTRIES in these two industrial fields.

AUTOMOTIVE *and Aviation* INDUSTRIES

A CHILTON Publication • Chestnut and 56th Streets, Philadelphia, 39, Pa.

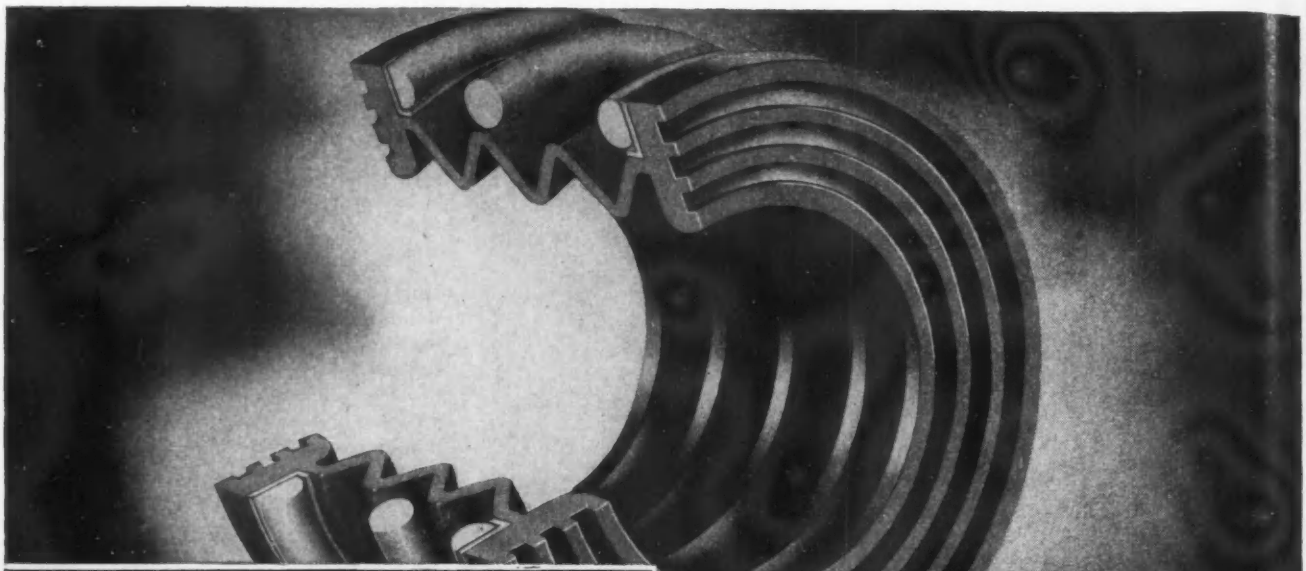
The forging of metal parts is and always has been the basic process in mechanical progress, whether in peace or in war.

Utmost strength and toughness with minimum weight is attained only in drop forging—more properly termed "impact die-forging." For it is the impact of the blow of the upper die on the hot metal resting in the lower die that gives to that metal the improved physical properties that fit it to withstand "unpredictable" loads and stresses.

Modern drop hammers—Chambersburg Hammers—have been responsible for the great progress in drop forging through (1) precision of operating mechanism, (2) increased ram velocities and (3) increased anvil-to-ram weight ratios.

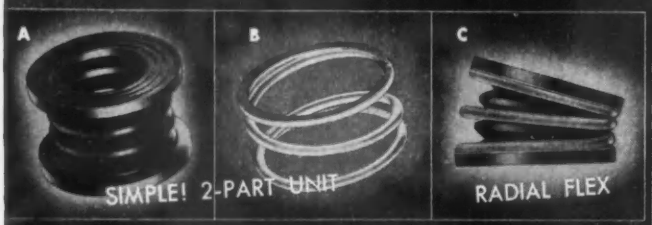
Thus to the basic importance of forging has been added the refinement of scientific hammer design and manufacture.

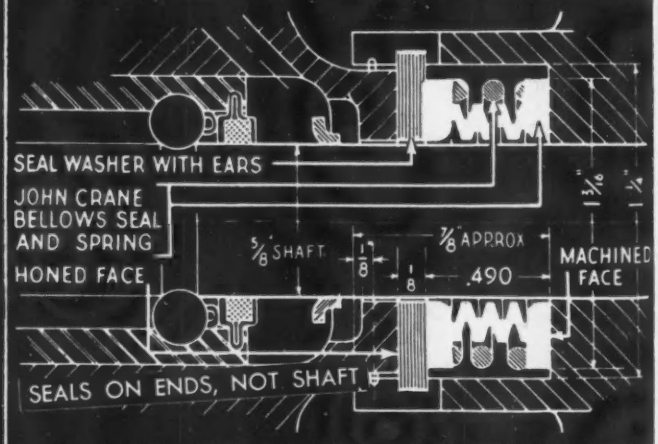
Chambersburg Engineering Company
Chambersburg, Pennsylvania



New JOHN CRANE PUMP SEAL

Specified as STANDARD EQUIPMENT!





New Records . . .

Being selected as standard equipment—is a long, hard row to hoe, for any product. Such an item must be better than good—better than "the market." Today, in less than one year, leading pump manufacturers, designers and engineers are specifying the new John Crane Bellows Seal because it not only "came through" proving ground tests, but set up efficiency levels not equaled heretofore . . . Why not investigate this revolutionary improvement for your line? Simply send blue prints and operating conditions. Our engineers will submit layouts and full data. Detailed literature.

CRANE PACKING COMPANY, 1818 CUYLER AVENUE, CHICAGO
Branches: Baltimore, Boston, Buffalo, Cleveland, Dallas, Detroit, Houston, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis, Tulsa
CRANE PACKING CO., LTD., HAMILTON, ONTARIO, CANADA
Branches: Montreal, Toronto, Vancouver

☆ ☆ ☆

Specifications . . .

A—Seal is a 2-part unit, bellows and spring, assembled, ready for installation. Bellows is a series of accordion-like folds connecting flanged ends. Both bellows and flanged ends are one-piece special John Crane synthetic rubber compound. Serrated contact facings are a series of concentric grooves and flat faced ribs; they effect a perfect seal at the washer and driving-base points—not on the shaft.

B—Springs furnished to accommodate service, pressure and size requirements: round or rectangular; stainless, steel-plated, phosphor-bronze, etc.

C—Because of seals ability to flex at every segment of the arc and compress as a *unit*, parallelity is maintained. Thus pressure variation, misalignment, fan-thrust, torque or vibration set up by unbalanced impeller are automatically accommodated.

Retaining ferrules are provided for large diameter seals. They distribute the spring pressure uniformly against the under side of the flanges, thus insuring total suction contact, at both ends.

Liquids handled: ethylene glycol, hydrocarbons, aqueous and approved anti-freeze solutions, grease, salt water, alcohols, acids, alkalis, etc.

POSTWAR PREVIEW

AUTOMOBILES—Costs after the war will be higher due to lowered production rates and increased wage scales.

Something can be done . . . INCREASED PRODUCTION . . . with less manpower.

YODER ROLL FORMING MACHINES are designed for laborsaving ease of operation and efficient quality production.

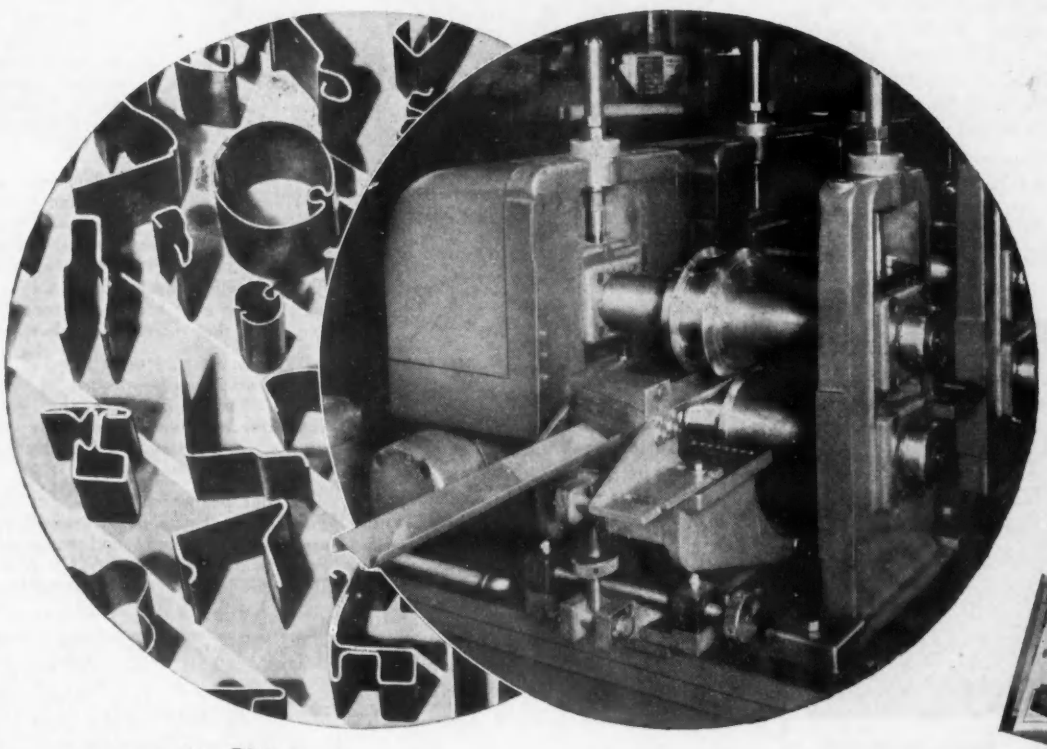
THE CHANGING OF ROLLS is a matter of small moment compared with the laborious unfastening, complicated adjusting and the reassembling of obsolete types of roll forming machines. This is just one of the features exclusive with Yoder.

GREATER PRODUCTION OF QUALITY PARTS can be rolled out on a Yoder than on any other machine of similar type or by any other method. Yoder has pioneered in the development of roll forming machines and many satisfied customers have said, "You get the latest improvements from Yoder." Roll forming is superior to other methods in that STRENGTH is added to parts; CHEAPER base metals can be used; MACHINING is reduced or eliminated.

YODER Roll Forming Machines are THE machines of the hour! Let them help you. Write to us.

THE YODER COMPANY

Cleveland 2, Ohio • U. S. A.



We have a catalogue . . . WRITE FOR IT!

METAL • WORKING • PRODUCTION • MACHINERY

ENGINEERING

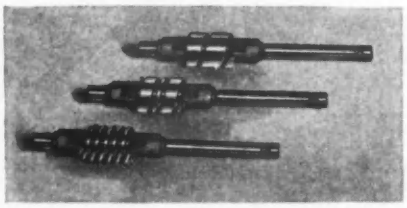
YODER

MANUFACTURING

PRECISION PARTS

WORMS

To Bait the Enemy



The worm as turned.

Precision-machined parts for what it takes to destroy the enemy—Ace is turning them out by the thousands. (Ace has an Axis to grind!) These hardened-steel worm-shafts, for example, are part of vital radio equipment. The triple-lead worm-thread is ground right from the solid blank, after hardening. This insures the concentricity between the pitch-diameter of the worm and the bearing-diameter. The bearing-diameter itself is ground to a total tolerance of .0003".

Since the war began, Ace has been supplying America's outstanding manufacturers with small parts and assemblies calling for stamping, machining, heat-treating, or grinding. Ace has provided not only the industry's most modern equipment, but the skill, the background, and the ingenuity to use those machines in new ways to improve results, shorten schedules, and get the work out. Keep Ace up your sleeve for post-war plans. Occasional capacity is available for current work.

Modern equipment . . . modern management.

ACE

TRADE MARK

ACE MANUFACTURING CORPORATION
for Precision Parts

ARMY (E) NAVY

1241 E. ERIE AVE., PHILADELPHIA 24, PA.

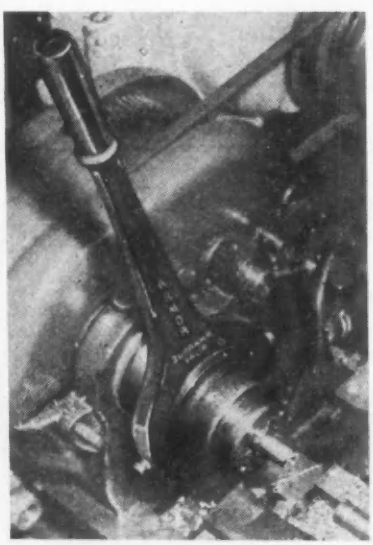
New Production Equipment

(*Continued from page* 80)

assembly may be moved in or out without changing the setting of the rollers.

The Cincinnati Box Tool permits the use of stock ground carbide tool bits of several different types. No special ground tool bits are required.

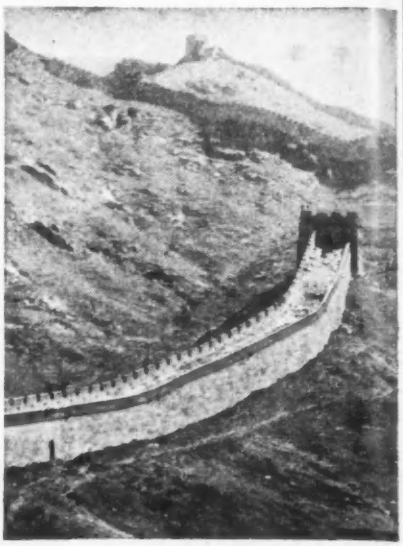
THE Aircraft Machinery Corporation, Burbank, Cal., is now shipping the Armor collet chuck for small production lathes. A feature of the Armor collet chuck is the Wedge-Lock which prevents slippage whether the chuck is working on soft aluminum or hard alloy steel; and holds material several thousandths over or under size. Stock



Armor collet chuck

is forced against the stop and securely held there by a combination draw-back and push-out action which insures accurate stock length. No heat is generated or power consumed by the Armor collet chuck since it revolves with the spindle and requires no bearings or lubrication. Full spindle capacity is provided; and Armor collets are available in round, square and hexagon types. Adapters can be furnished on order to accommodate most of the well known collets.

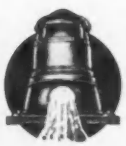
THE No. 24 vertical spindle rotary surface grinder has recently been added to the line of large surface grinders made by Hanchett Manufacturing Company, Big Rapids, Mich. Its 30-in. rotary magnetic chuck is equipped with a Neu-T-Rol demagnetizing switch and is traversed into grinding position by push-button control. The grinding wheel head has hand, power or automatic traverse with power being fur-



The Great Wall of China
Built About 3000 B.C.

BUILT TO LAST

A LONG LONG TIME



The founders of the Layne Organization realized the tremendous importance of water as a health, safety and industrial necessity. They pledged themselves never to sacrifice quality in the manufacture of Layne Pumps and Well Water Systems. That pledge, to the ever grateful thanks of thousands of Layne Well Water System owners, has been faithfully kept.

Today as always, Layne Pumps and Well Water Systems are still being made of the very finest quality materials. They possess highly important and exclusive features of construction which measureably lengthen their long life. And in addition, they embody outstanding and thoroughly proven engineering ideas that guarantee highest efficiency.

Wherever modern well water producing equipment is used—whether in the United States or in foreign lands, that which bears the name of Layne is definitely recognized as the world's standard by which all other makes are judged.

If your postwar plans call for the use of more water, Layne engineers will gladly cooperate in providing sound recommendations. For literature address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tenn.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minnesota, Minneapolis, Minn. ★ International Water Supply Ltd., London, Ontario, Canada

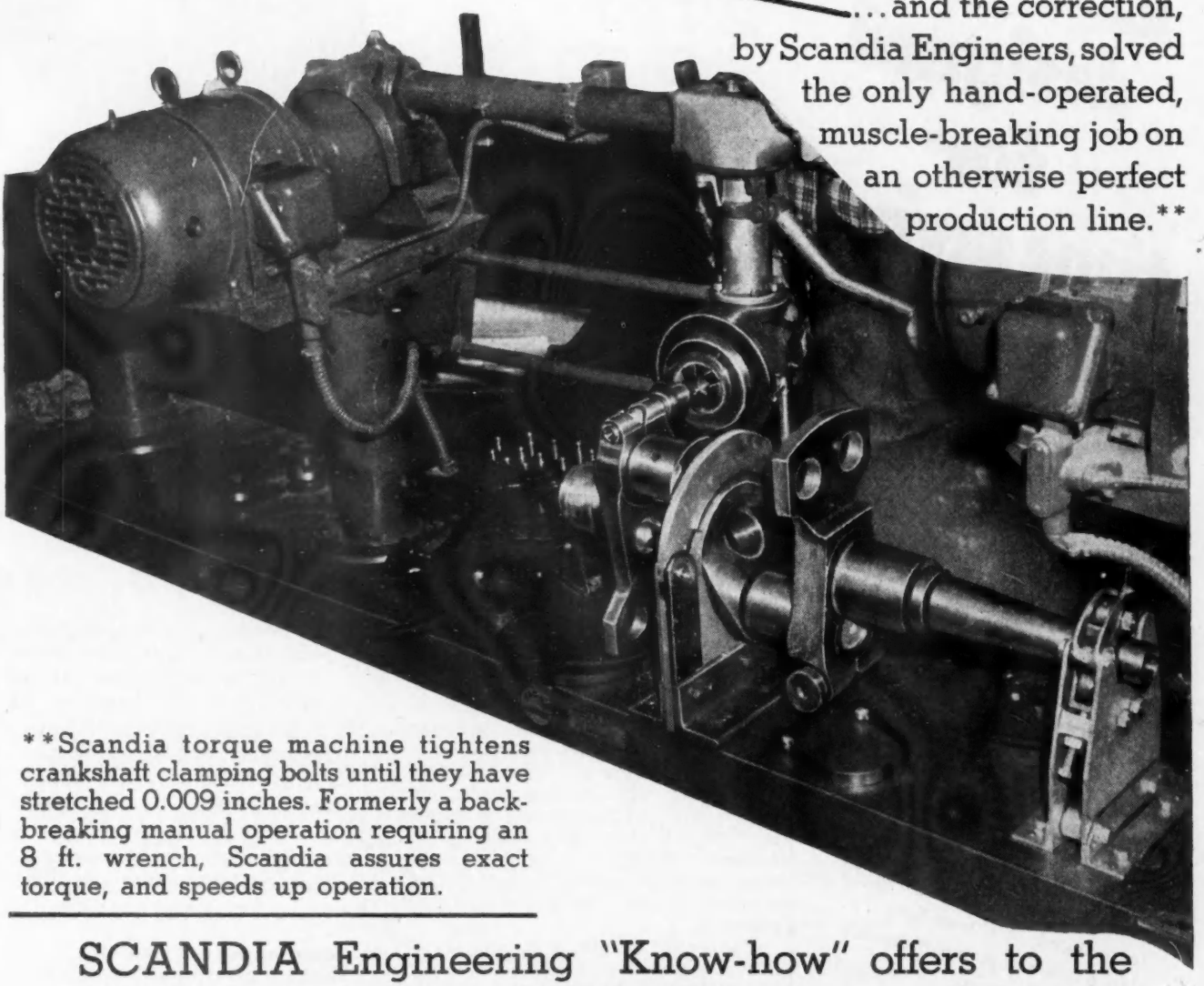
LAYNE

WELL WATER SYSTEMS
DEEP WELL PUMPS

Builders of Well Water Systems
for every Municipal and Industrial Need

CAN You can't do THAT by machine!

...and the correction, by Scandia Engineers, solved the only hand-operated, muscle-breaking job on an otherwise perfect production line.**



**Scandia torque machine tightens crankshaft clamping bolts until they have stretched 0.009 inches. Formerly a back-breaking manual operation requiring an 8 ft. wrench, Scandia assures exact torque, and speeds up operation.

SCANDIA Engineering "Know-how" offers to the AUTOMOTIVE and AVIATION field, exceptional facilities for designing and building automatic TORQUE machinery from the smallest size stud to the largest size engine bolt.

Scandia MANUFACTURING CO.

NORTH ARLINGTON NEW JERSEY

designed for time saving

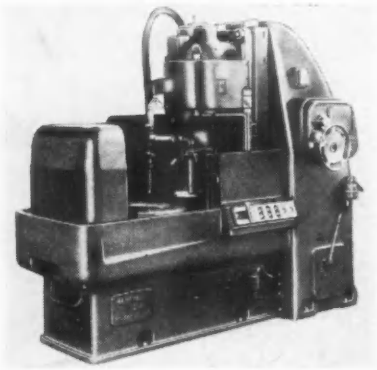
Quick-precision shimming with Laminum often cuts assembly time 20 to 30%. Is introduced without fuss ... also eases shop, maintenance and service routine.

Shims cut to your specifications. Stock shim materials obtainable from your dealer. Write us for further information and shim application chart.

Laminated Shim Company
Incorporated
51 Union Street • Glenbrook, Conn.

LAMINUM
TRADE MARK
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

2044



Hanchett No. 24 vertical spindle rotary surface grinder

nished by a 2 hp 900 rpm motor. The motor driven wet grinding system includes a coolant pump driven by an ½ h.p. motor. The No. 24 is equipped with a swing arm wheel dresser, ammeter for determining the cutting action of the grinding wheel and flood light.

Financial Plight of Aircraft Industry

(*Continued from page* 19)

One cannot escape the conclusion that there will be a period of months, and perhaps of more than a year, during which the inflow of funds will be virtually stopped while the companies do their product engineering and prepare for peacetime work. During this period they must maintain their engineering staffs and keep at least a nucleus of their organization. Of course every effort will be made to find other ways of keeping busy as many of the thousands of workers as possible. There will be the continuing burden of property and other taxes, depreciation charges and other expenses. These costs will run into large sums each month and the aircraft companies are fearful that their financial resources will not hold out until peacetime sales commence and they can achieve a normal peacetime operating status.

The events of the war have amply demonstrated that America must have for all time in the future a strong aircraft industry. This can only be possible if the industry has sufficient finances to do its job and do it well. The position of leadership in aircraft engineering and production technique which it now has can only be maintained if the aircraft industry has the resources to maintain itself.

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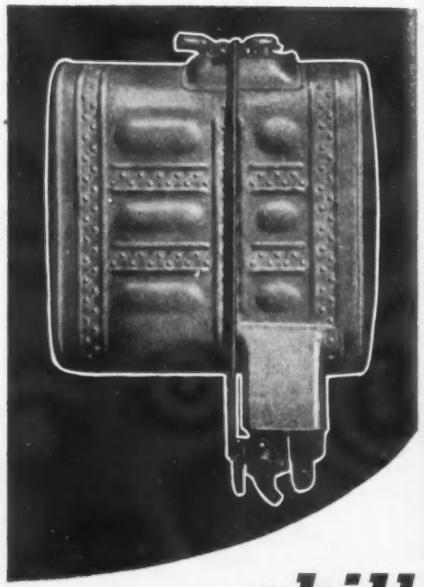

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Much of the work at Mercury is the making of assemblies on which others have failed . . . because Mercury's 24 years of aircraft manufacture has developed the technical skill which can come only from long experience.

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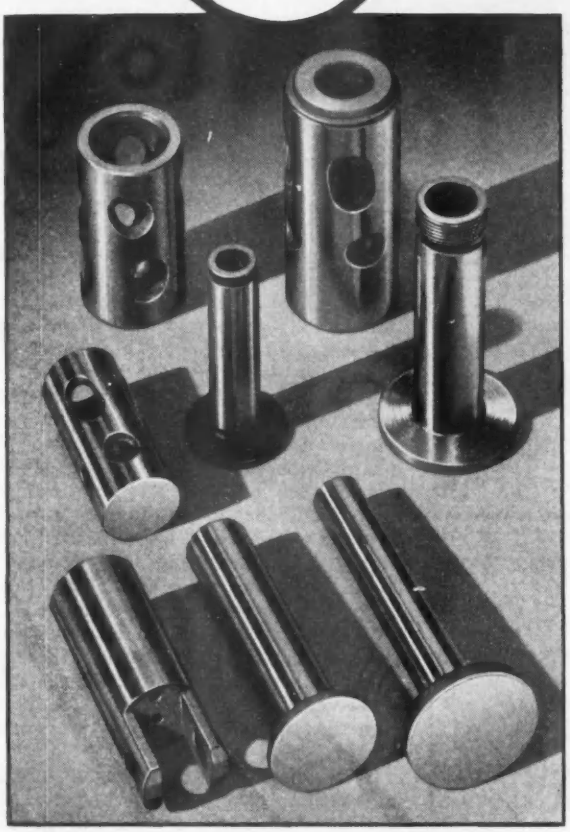

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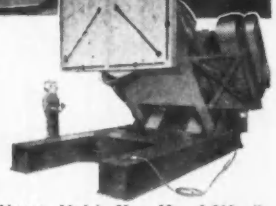

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Change in Requirements of Steel for War

(*Continued from page* 50)

does not abate the uneasiness of producers that under the circumstances this or that competitor may be able to jump the gun in the transition to peacetime business.

Another grave problem is the necessary readjustment of metal values as the result of changes in production costs. In pre-war days, the ratio of the price of aluminum to that of copper and other metals was on a competitive basis, so far as major products were concerned, considering the lighter weight of aluminum. With secondary aluminum having recently dipped sharply in price as the result of heavy offerings and the possibility that primary aluminum prices may sooner or later reflect economies in production, resulting from increased plant capacity and metallurgical progress, the much broader use of the light metal in automobiles is freely predicted.

In a recent directive the Operating Committee on Aircraft Materials Conservation ordered the use of columbium-bearing corrosion-resisting steel restricted to parts of the exhaust system that come into contact with exhaust gases and that are exposed to high temperatures; supercharger systems; vital engine or engine accessory parts, exposed to temperatures in excess of 800 deg. F.: and welding rods and electrodes. Columbium supplies come from abroad and are critically light. To relieve the paucity in the supply of precision anti-friction bearings, the Committee recommended the use of plain and sleeve type bearings or commercial type bearings. Restrictions on the use of corrosion-resisting steel in aircraft fire walls are being investigated with a view to easing them.

Restrictions on the use of chromium and nickel in the manufacture of valves for the new engines that will go into the expanded 1944 truck program, have been removed.

Industry's Output Now At $10½ Billion Rate

Automotive companies produced war materials valued at $8,840,000,000 in 1943, George Romney, managing director of the ACWP, reported. This total is 88 per cent greater than the industry's 1942 output of armaments, valued at $4,691,000,000, and is double the value of the industry's production of civilian goods in 1941, the peak peacetime year. The automotive industry currently is producing at an annual rate of $10½ billion, including output of $500,000,000 worth of replacement parts.

Since Pearl Harbor the industry has filled $13,600,000,000 in war orders and enters 1944 with a backlog of $14 billion, of which 50 per cent is in contracts for aircraft, aircraft engines, parts and propellers.

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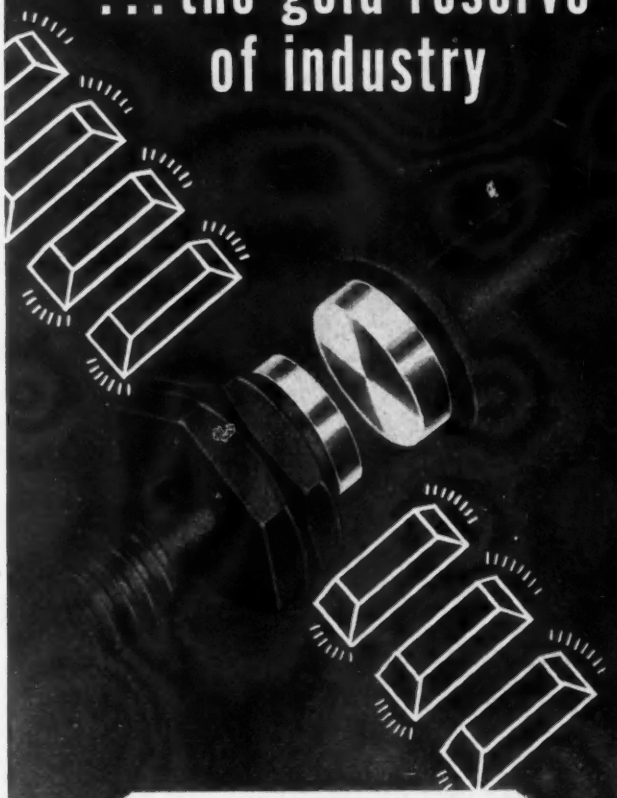

...enables contacts to go on the "three-shift" standard

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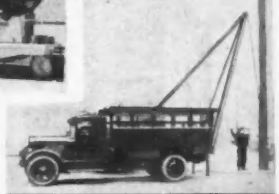

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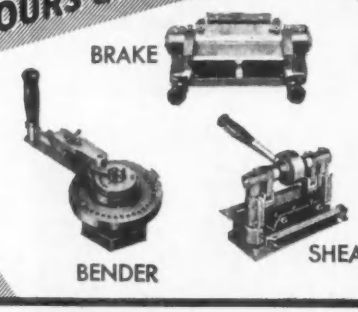

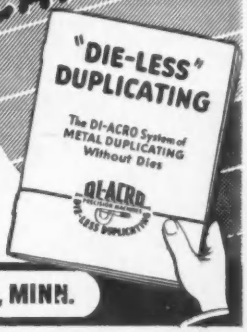

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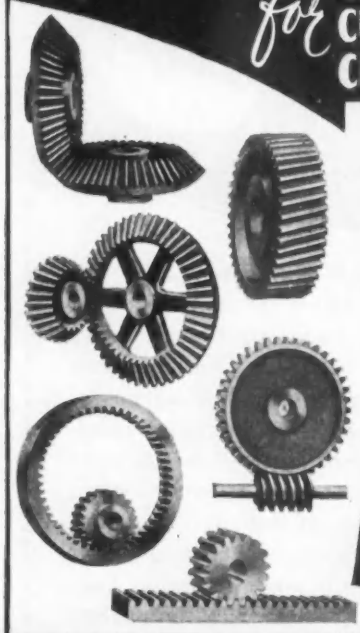

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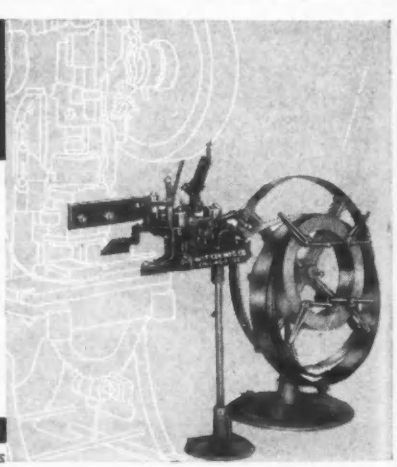

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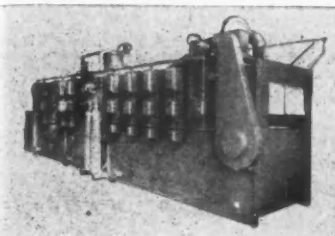

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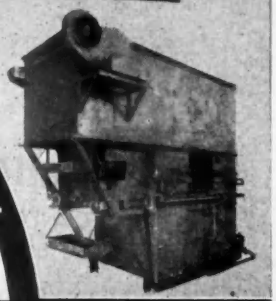

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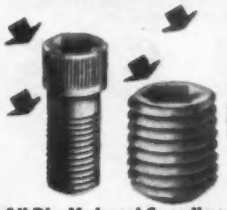
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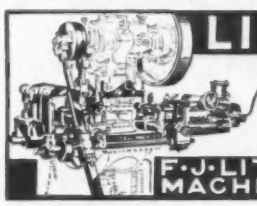
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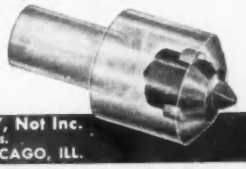

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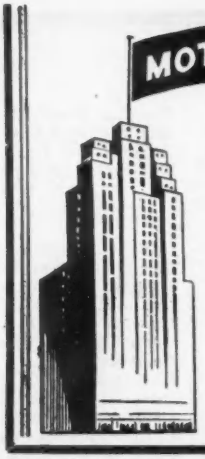

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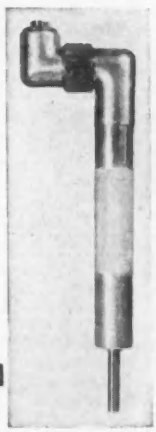

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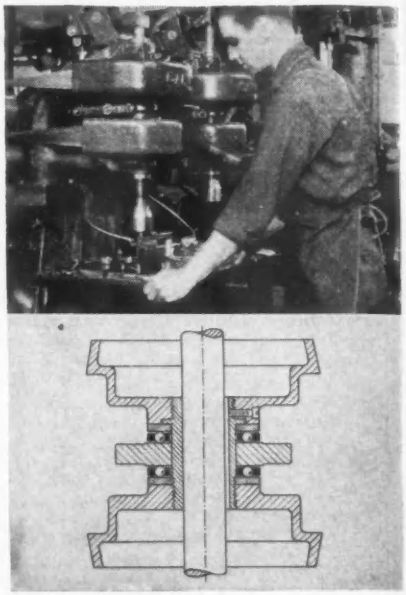
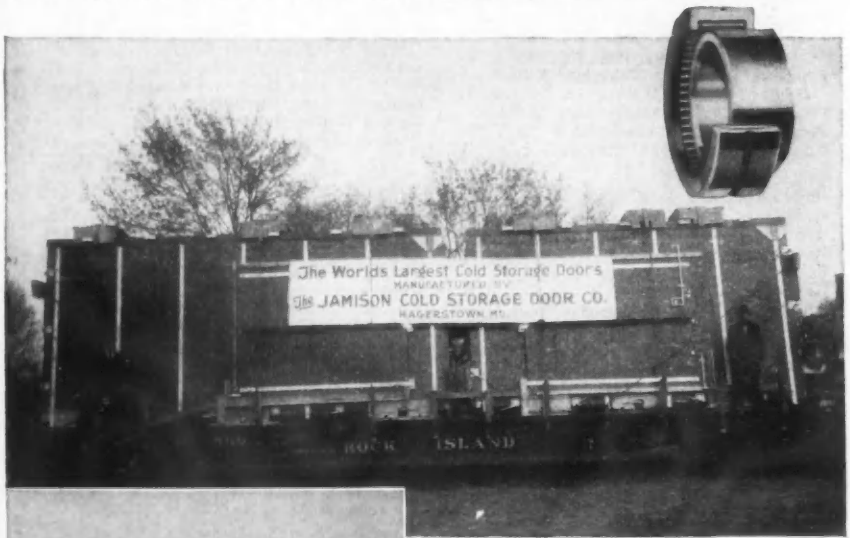
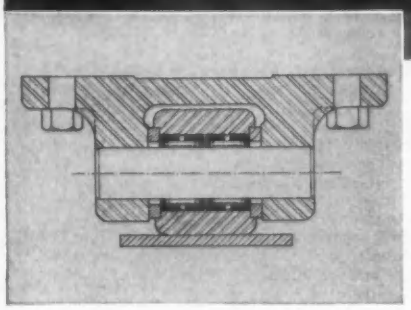
NAKED HULLS GROW INTO HUGE PBY Naval Patrol Bombers as they pass along the conveyor system of the production line at the Consolidated Vultee Aircraft Corporation. The hulls are supported on cradle-like dollies which move the ever-increasing load smoothly to its completion while removable sectional platforms provide ready access to the superstructure of the airplanes. To safeguard the vital wheel axles of the conveyor dollies so that the heavy load will be carried steadily and safely and without time-consuming stoppages, the makers of the conveyor system selected Type NCS Needle Bearings for their high capacity and low friction coefficient.

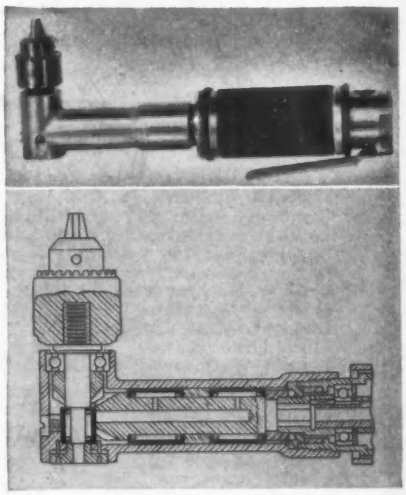


TAPPING OPERATIONS are done swiftly and accurately with this Garvin No. 2-X Duplex Automatic Tapper manufactured by the Western Machine Tool Works. The builders of this machine selected Torrington Ball Thrust Bearings for application on the spindle between the forward and reverse driving friction cones, as shown in the cross-section, because their sturdy construction and high accuracy could withstand the repeated shock loading which the application required.





"WORLD'S LARGEST" are these cold storage doors made by the Jamison Cold Storage Door Company for a 67° below zero cold chamber at Wright Field. To help support and lend ease to the operation of these colossal doors, a Needle Bearing equipped floor roller assembly has been applied to the bottom of the hinge sides, as shown in the cross-section, to provide ease of manual operation.



RIVET HOLES IN TIGHT CORNERS and small openings are easily drilled with this pneumatic angle drill made by the Chicago Pneumatic Tool Company. Because of their small size and high load capacity NCS Needle Bearings were selected to carry the load on the shaft of these compactly designed tools, as illustrated in the accompanying cross-section of the drill.

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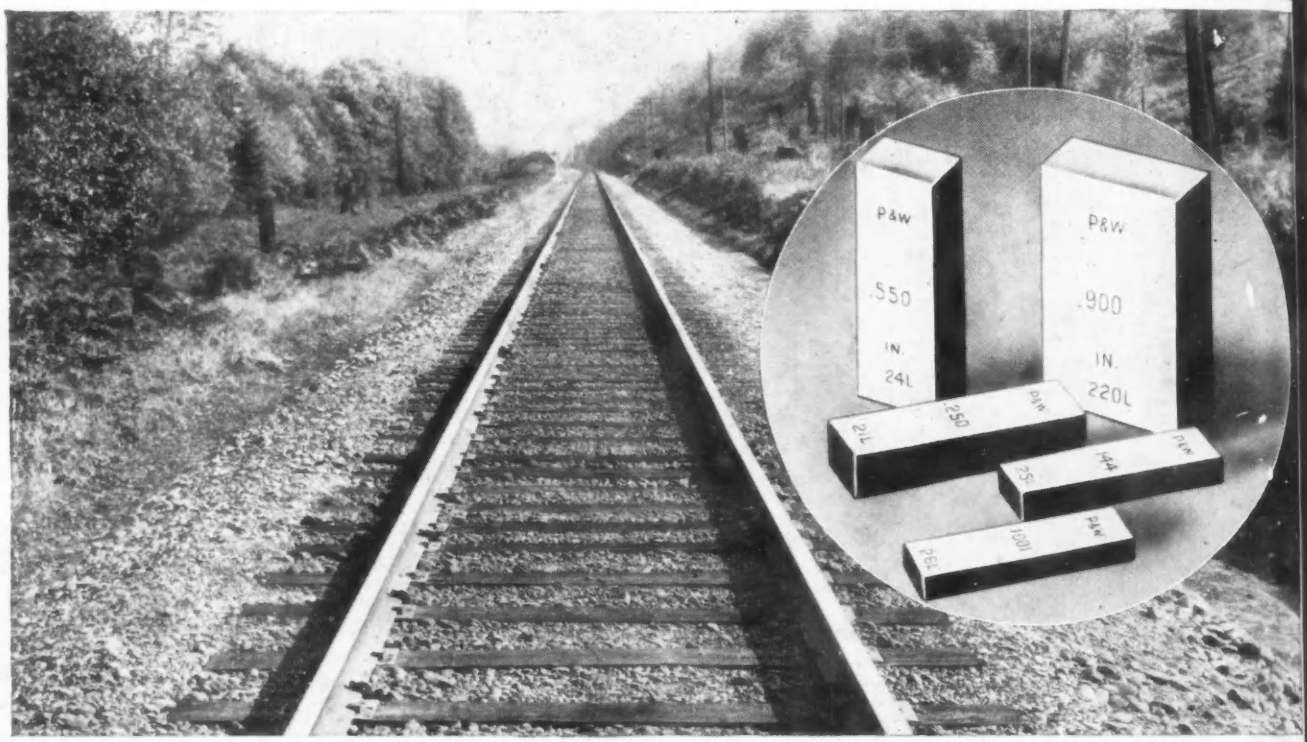

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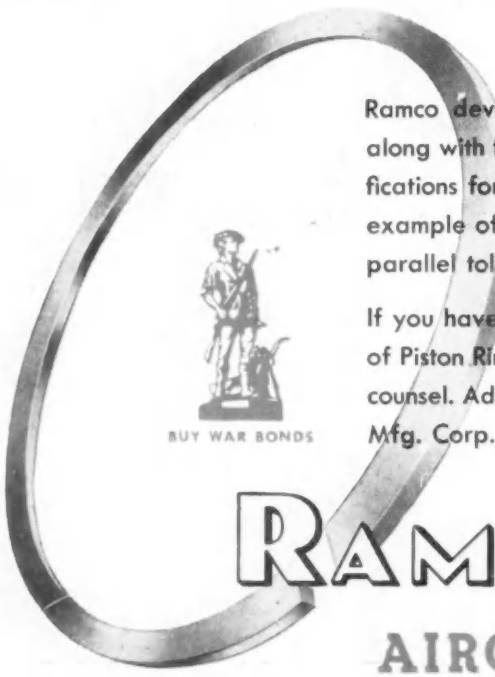

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